EXAMINING THE EFFECTIVENESS OF EDUCATIONAL TABLET PC APPLICATIONS TO TEACH DAILY LIVING SKILLS TO STUDENTS WITH INTELLECTUAL DISABILITIES

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ABSTRACT

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Mobile technology enhanced learning environments can support the education of individuals with intellectual disabilities (ID). Literature reveals that information and communication technology (ICT) based education obtained successful results in the development of academic, social and adaptation skills for individuals with ID. The main purpose of this study is to investigate the effectiveness of educational tablet applications to teach a daily living skill to individuals with ID. In addition, it is examined whether a newly learned skill can be protected at one, three and four weeks after training and whether it can be generalized to different tools. Usability of tablet applications is examined in terms of effectiveness, efficiency and satisfaction (social validity). Multiple-baseline across subjects design is used as single case research in the study. Seven individuals with ID and five special education teachers form the group of participants of the study. To be eligible for participation, individuals are expected to meet some requirements such as ability to follow simple verbal instructions. In the implementation process of the study, baseline, probe, intervention, generalization and follow-up sessions are employed. Also, five kinds of

data are collected: effectiveness, reliability, social validity, maintenance and generalization, and usability. In conclusion, results show that tablet application is an effective tool to teach a daily living skill to individuals with ID. In addition, the newly learned skill is protected at one, three and four weeks after the training and individuals can generalize the skill to different tools. Tablet application is updated according to pilot study results. As a result, an improvement in the application is detected in terms of efficiency and satisfaction components of usability when data from pilot study and main study are compared.

Keywords: Special Education, Mobile Technologies, Tablet Applications, Single Subject Design, Individuals with Intellectual Disabilities, Daily Living Skills

ÖZ

ZİHİNSEL ENGELLİ ÖĞRENCİLERE GÜNLÜK YAŞAM BECERİLERİNİN ÖĞRETİMİNDE EĞİTSEL TABLET BİLGİSAYAR UYGULAMALARININ ETKİLİLİĞİNİN İNCELENMESİ

Yeni, Sabiha
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Mobil teknolojiler ile destekli öğrenme ortamları, zihinsel engelli öğrencilere eğitimleri için destek sağlar. Alanyazın, BIT destekli eğitim ile zihinsel engelli bireylerin eğitiminde sıklıkla ortaya çıkan sorunlardan olan akademik, sosyal ve uyum becerilerinin geliştirilmesi konularında başarılı sonuçlar alındığını ortaya koymaktadır. Bu çalışmanın temel amacı eğitsel tablet bilgisayar uygulamalarının zihinsel engelli bireylerin günlük yaşam becerilerini geliştirmedeki etkililiğini araştırmaktır. Ayrıca, öğrendikleri yeni bilgileri eğitimden bir, üç ve dört hafta sonra koruyabilme ve farklı araçlara genelleyebilme durumları da araştırılmıştır. Tablet uygulamasının kullanışlılığı da etkililik, verimlilik ve memnuniyet (sosyal geçerlilik) değişkenleri açısından incelenmiştir. Bu araştırmada, tek denekli araştıma modellerinden "denekler arası çoklu başlama" tekniği kullanılmıştır. Araştırmanın çalışma grubu yedi öğrenci ve beş özel eğitim öğretmeninden oluşmaktadır. Katılımcı olabilmek için bazı önkoşul becerileri sağlamaları beklenmiştir (örneğin basit sözel yönergeleri takip edebilme, vs.). Bu çalışmanın yürütülmesi esnasında şu oturumlar gerçekleştirilmiştir: başlama seviyesi, yoklama, öğretim, genelleme ve

izleme oturumları. Ayrıca araştırma süresince beş tür veri toplanmıştır: Etkililik, güvenirlik, sosyal geçerlilik, devam ettirilebilirlik - genellenebilirlik, kullanışlılık. Sonuç olarak, elde edilen bulgular eğitsel tablet uygulamasının zihinsel engelli bireylere günlük yaşam becerisini öğretmede etkili bir araç olduğunu göstermiştir. Ayrıca yeni öğrenilmiş beceri, eğitimden bir, üç ve dört hafta sonra da korunmuş ve bireyler tarafından farklı araçlara genellenebilmiştir. Tablet uygulaması pilot çalışmadan sonra iyileştirme amaçlı güncellenmiştir. Daha sonra pilot çalışma ve esas çalışma sonuçları incelendiğinde, özellikle verimlilik ve memnuniyet değişkenleri açısından uygulamada iyileşme elde edildiği gözlemlenmiştir.

Anahtar kelimeler: Özel Eğitim, Mobil Teknolojiler, Tablet Bilgisayar Uygulamaları, Tek-Denekli Araştırma Modelleri, Zihinsel Engelli Bireyler, Günlük Yaşam Becerileri

To my dear family,

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TABLE OF CONTENTS

ABSTRACT v
ÖZ vii
ACKNOWLEDGMENTS x
TABLE OF CONTENTS xii
LIST OF TABLES xvi
LIST OF FIGURES xvii
LIST OF ABBREVIATIONS xviii
CHAPTERS 1
1. INTRODUCTION 1
1.1 Background of the Study 1
1.2 The Problem Statement 3
1.3 The Purpose of the Study 4
1.4 The Significance of the Study 4
1.5 Research Questions 6
1.6 Definition of Terms 7
1.7 Organization of Study 8
2. LITERATURE REVIEW 9
2.1 Definition of Intellectual Disabilities (ID) 9
2.1.1 Intellectual Abilities 10
2.1.2 Adaptive Behavior 10
2.1.3 Age of Onset 10
2.2 Characteristics of Individuals with ID 11
2.2.1 Lack of Adaptive Skills 11
2.2.2 Low Success in Education 11
2.2.3 Delayed Speech and Language Development 12
2.2.4 Lack of Self-Regulation 12

2.2.5 Abnormal Physical Development 12
2.3 Individuals with ID and Development of Daily Living Skills 13
2.4 Technology Usage in Special Education Field..... 14
2.4.1 Computer-based Instruction 15
2.4.2 Mobile Devices-based Instruction..... 17
2.4.3 Tablet -based Instruction..... 19
2.4.4 Teaching Daily Living Skills via Technological Devices..... 22
2.4.5 Technology supported Instruction and Special Education Teachers 25
2.5 Technology Usage in Special Education Field: Turkish Literature 26
2.5.1 Computer-based Special Education in Turkey..... 26
2.5.2 Video modeling in Turkey 29
2.5.3 Special Education Teachers'/Parents' Views/Attitudes about Technology Use in Turkey..... 31
2.5.4 Mobile Technology supported Special Education in Turkey..... 33
2.5.5 Other Technologies (Touch table, games etc.) for Special Education in Turkey 34
2.6 Usability 35
2.6.1 Definition of usability 36
2.6.2 Usability Studies about Special Education 36
2.6.3 Usability evaluation methods..... 38
2.6.4 Mobile Technologies and Usability 40
2.7 Implications of Literature Review..... 41
3. METHODOLOGY..... 43
3.1 Introduction 43
3.2 Overall Design of the Study 43
3.2.1 Single-Case Research Design 44
3.2.1.1 Characteristics of Single Case Research Design (SCRD)..... 44
3.2.1.2 Multiple Baseline and Multiple Probe Designs 45
3.3 Dependent and Independent Variable 46
3.4 Participants 47
3.4.1 Requirements for Participants..... 50
3.5 Setting and Materials..... 50

3.6 Description of the SCV Tablet Application 51
3.7 The Target Stimulus (Main Instruction) 53
3.8 Experimental Conditions 54
3.9 Data Collection Procedure and Instruments 58
3.9.1 Collection of Effectiveness Data 58
3.9.2 Collection of the Reliability Data 59
3.9.3 Collection of the Social Validity Data 60
3.9.4 Threats toward the Internal Validity 7 61
3.10 Pilot Study 63
3.11 Data Analysis Procedure 67
4. RESULTS 69
4.1 Introduction 69
4.2 Effectiveness Data 70
4.2.1 Effectiveness Data of First Participant OA 70
4.2.2 Effectiveness Data of Second Participant KE 71
4.2.3 Effectiveness Data of Third Participant BG 72
4.3 Maintenance and Generalization Data 73
4.4 Reliability Data 73
4.4.1 Inter-observer Reliability Data 74
4.4.2 Procedural Fidelity Data 74
4.4.3 Inter-coder Reliability Data 76
4.5 Social Validity Data 76
4.6 Usability Data 85
4.7 Summary of the Results 91
5. DISCUSSION AND CONCLUSION 93
5.1 Effectiveness of SCV Application 94
5.2 Maintenance and Generalization of Newly Learned Knowledge 96
5.3 Reliability of the Study 97
5.4 Social Validity of the Study 97
5.5 Usability of SCV application 99
5.6 Responses of Research Questions 101
5.7 Novelty of the Study. 104

5.8 Practical Implications for Special Education Teachers/ Practitioners..... 105
5.9 Limitations of the Study 106
5.10 Suggestions and Implications for Future Research 107
REFERENCES..... 109
APPENDICES 127
A. THE PARENT PERMISSION FORM..... 127
B. THE DEMOGRAPHIC INFORMATION FORM 129
C. THE REINFORCEMENT FORM..... 131
D. PROBE, FOLLOW-UP AND GENERALIZATION SESSIONS DATA COLLECTION FORM..... 133
E. INTERVIEW PROTOCOL FOR THE SPECIAL EDUCATION TEACHERS135
F. OBSERVER NOTIFICATION SHEET 137
G. PROBE, FOLLOW-UP AND GENERALIZATION SESSIONS PROCEDURAL FIDELITY CHECKLIST 141
H. INTERVENTION SESSIONS PROCEDURAL FIDELITY CHECKLIST .. 143
I. SATISFACTION SURVEY FOR SPECIAL EDUCATION TEACHERS 145
J. OFFICIAL PERMISSION FROM METU 147
K. TEACHERS' VIEWS ABOUT EDUCATIONAL USAGE OF TABLETS (TURKISH) 149
L. TEACHERS' VIEWS ABOUT THE SCV TABLET APPLICATION (TURKISH) 153
M. EQUIPMENTS USED IN THE STUDY 157
N. PRACTICAL IMPLICATIONS FOR SPECIAL EDUCATION TEACHERS / PRACTITIONERS (TURKISH VERSION).....159
CURRICULUM VITAE 161

LIST OF TABLES

TABLES

Table 3.1 Steps of task analysis 47
Table 3.2 Demographic Information of Participants 49
Table 3.3 Educational Background of Participants 49
Table 3.4 Demographic Information of Parents 50
Table 3.5 Data Collection Procedure, Instruments and Roles of Practitioners 58
Table 3.6 Time Schedule of Pilot Study 64
Table 4.1 Main Titles of Findings related with Research Questions 69
Table 4.2 Inter-observer reliability data for each participant and session 74
Table 4.3 Procedural fidelity data for all sessions 75
Table 4.4 Mean of Teachers' Satisfactions about the SCV application 77
Table 4.5 Teachers' views about educational usage of tablets 78
Table 4.6 Teachers' views about the SCV tablet application 81
Table 4.7 Changes in SCV Application Used in The Pilot Study 86
Table 4.8 Participants' success level according to steps of skill in Pilot Study (Before Changes in Application) - Effectiveness data 87
Table 4.9 Participants' Success Level According To Skill Steps in Main Study (After Changes in Application) - Effectiveness Data 88
Table 4.10 Differences in Baseline Sessions' Success Rate between Pilot Study and Main Study (Effectiveness) 89
Table 4.11 Differences in Probe Sessions' Success Rate between Pilot Study and Main Study (Effectiveness) 89
Table 4.12 Differences in Time of Intervention Sessions between Pilot Study and Main Study (Efficiency) 90

LIST OF FIGURES

FIGURES

Figure 2.1 Number of publications in peer reviewed journals with keywords “autism + computer” for the time-span 1970-2011 (Ploog et al., 2013) 16
Figure 3.1 Intervention sessions..... 51
Figure 3.2. Probe sessions..... 51
Figure 3.3 Screen captures of tablet application (sweeping carpet with vacuum)... 52
Figure 3.4 The Flowchart of the Implementation Process 54
Figure 3.5 The Flowchart of Baseline, Probe, Follow-up and Generalization Sessions 56
Figure 3.6 The Flowchart of Intervention Sessions 57
Figure 3.7 Percentage of correct responses for DS during baseline, intervention and generalization probe sessions..... 66
Figure 3.8 Percentage of correct responses for IG during baseline, intervention and generalization probe sessions..... 67
Figure 4.1 Three Participants’ Percentage of Correct Actions for the Baseline, Treatment, Follow-up and Generalization Sessions..... 72

LIST OF ABBREVIATIONS

ICT	Information and Communication Technology
ID	Intellectual Disabilities
BIT	Bilgi ve İletişim Teknolojileri
ASD	Autism Spectrum Disorder
EHS	Elektrikli süpürge ile Halı Süpürme
SCV	Sweeping Carpet with Vacuum cleaner
TÜBİTAK	The Scientific and Technological Research Council of Turkey
UEM	Usability Evaluation Method
SCRD	Single Case Research Design
SGD	Speech-Generating Devices

CHAPTER 1

INTRODUCTION

This chapter reveals the justification for research issue by presenting background to the study, the purpose of the study, the significance of the study and the questions of the research.

1.1 Background of the Study

The number of children with intellectual disabilities (ID) continues to grow; the educational needs of this community must be met with the help of new technology based instructional methods. Individuals with special education needs can be defined as "those who, because of a disability, require special education and related services to achieve their fullest potential" (Hasselbring & Williams, 2000). Intellectual disabilities is characterized by significant limitations both in intellectual functioning and in adaptive behavior as expressed in conceptual, social, and practical adaptive skills (AAIDD, 2010). One of the main objectives must be to improve the behavior of such individuals and their relationships with their environment (Fernández-López, Rodríguez-Fórtiz, Rodríguez-Almendros & Martínez-Segura, 2013). In addition, another important goal for children with ID is to attain daily living skills that would advance self-determination, greater independence and autonomy. Several researchers have used technological interventions to improve daily living skills of this group of individuals.

Technology is useful for creating new ways of learning and teaching (Bertini & Kimani, 2003) and gives special individuals opportunities to engage in basic drill and practice, simulations, exploratory, or communication activities that are matched to

their individual needs and abilities (Edwards, Blackhurst & Koorland, 1995). Computers and computing devices help to capture the attention of individuals with special needs and get them to focus on the tasks to be performed – typically problematic in the education of these individuals (Fernández-López et al., 2013; Çatak, 2006). Başoğlu (2009) compared traditional teaching method and computer-assisted teaching method in the study. According to results of the study, computer-based education was much more interesting and simple than traditional method; also, its learning process was shorter than the traditional lesson. In Turkey literature, Dalgın-Eyiip (2011), Tanju (2004), Aruk (2008), Kanpolat (2008), Özak (2008), Armutçu (2008), Çatak (2006) and Uçar (2007) also made investigations with regard to the effects of computer-based education in special education field. The outcomes of these research studies usually proved the advantages of computer-based education for special individuals.

Mobile devices can offer people with special education needs different kinds of help (Upadhyay, 2006): aids for carrying out functions in everyday activities become a means to communicate, to support them in the learning process and to use as an assistant (Fernández-López et al., 2013). Mobility features allow users to perform activities anywhere and anytime. Interaction through motion is also another important feature of mobile devices. They can detect movement when a user rotates or shakes the device. In addition, the touch screen interface makes them appealing and simple to use as well (Yee, 2012). Children love to touch things; it is a natural interaction, which requires no training. Also, many children do not have the skills necessary to work with a pencil or stylus, making this device ideal for people with cognitive disabilities.

In Turkey literature, there are a few studies about mobile technology supported special education. Doğan (2015) showed that technology-enhanced extracurricular activities affected participants in a positive way in terms of cognitive and physical development. Acungil (2014), investigated the effects of Tablet Computer Instruction Program presented via audio-visual technologies on teaching the use of tablet computer skill. Findings of study indicated that all participants learned to use tablet computer by meeting predetermined criteria. Hanaylı, Serbest and Ürekli (2015)

developed an Android application for the individuals with autism to make their social lives easier. Similarly Kuzu, Cavkaytar, Odabaşı, Erişti and Çankaya (2014) made a research to develop mobile skill teaching software, which is used by parents to teach daily life skills to their children with intellectual disability. There is a need in the Turkey literature for new studies about mobile technology based special education.

Tablet as a mobile device, has made computing more accessible for a wide variety of population. The simplicity of touch interactions and the portability of these devices have decreased the barriers for interacting with computers (Hourcade, Williams, Miller, Huebner& Liang, 2013). They can also enable additional social behaviors such as passing the device to a partner. As a multifunctional device, the tablet can be used to surf the web, read books, play games, and interact with online friends– all activities, which can aid the development of individuals with special education needs (Holstein, 2012).

The most important factors that affect the technology usage in education field are teachers' approaches and well-designed materials. The primary role of teachers in special education schools is to introduce and familiarize their individuals to the various intellectual aspects of the world around them (Nam, Bahn & Lee, 2013). So, special education teachers and specialists' approaches to instructional technology are very important. In addition, when the technological devices deliver well-designed and well-managed products, technology can help to improve the individuals with special education. Therefore, usability studies are necessary to produce well-designed materials for special education field.

1.2 The Problem Statement

The number of individuals with ID continues to grow; they have unique and numerous kinds of needs. In spite of great developments about interventions, the outcomes for a majority of these individuals are still poor (Hourcade, Bullock-Rest, & Hansen, 2012). As seen in the background of the study section, first problem is that there is a lack of literature about mobile technology usage in special education field and insufficient number of studies about empirical data supporting the use of

specific mobile technology supported approaches in the education of individuals with ID.

The second problem is that there is a lack of well-designed, usable products, which are used in mobile technologies for special individuals. Literature reveals that special individuals have different kinds of needs and individual differences. Positive effects of multimedia on special individuals are one other known fact, but the number of mobile device applications developed for special individuals are much less than it should be.

Another problem is about teachers' views and attitudes towards educational use of mobile technologies. Especially in Turkey, mobile technology usage in special education field is rare. Present study also aims to understand mobile technology experiences and views of special education teachers in Turkey.

1.3 The Purpose of the Study

The main purpose of this study is to examine the effectiveness of an interactive tablet application on daily living skills for individuals with ID, and to determine if there is an increase in the success level of daily living skills of these individuals after treatment. In the study, an educational tablet application aiming to develop skill to sweep carpet with vacuum cleaner for individuals with ID is used. It is also explored whether the persistence of these newly learned skills is protected at one, three and four weeks after training finished. Furthermore, if individuals with ID are able to learn daily living skills via educational interactive tablet applications, it is examined whether individuals can generalize these skills to different tools. Finally, usability issues of educational tablet PC application used in the study are explored in terms of effectiveness, efficiency and satisfaction. Satisfaction level of special education teachers are also examined as a social validity data.

1.4 The Significance of the Study

Investigating the effectiveness and usability issues of educational interactive tablet applications in the context of special education and perceptions of special education

teachers towards the use of tablet applications and their plans with regard to the use of tablets in learning environments is important in several aspects.

Turkish literature about technology supported special education shows that most of the studies are regarding with taking views or attitudes of parents and teachers about technology supported special education. There is a lack of empirical data supporting the use of technological devices for individuals with special education needs. In addition, in our country, although there are many studies related to computer-aided special education and video modeling, there is just a few studies about mobile technology usage in the field of special education. In this respect, present study is expected to be pioneer in the special education field and would contribute the literature by the property of tablet usage in the education of intellectually disabled individuals.

Tablets are seen as valuable tools that can be used to provide opportunities for individuals with special education needs to improve their skills. Nevertheless, the number of tablet applications developed for special education field is insufficient in Turkey. The tablet application examined in the study contributes the special education field in Turkey and lead to an increased number of tablet applications. In addition, this investigation provides some useful information for educators, administrators and parents to consider using tablets and tablet applications with educational purposes in special education.

Designing and developing usable software gives hope and opportunities to individuals with special needs. Special individuals can benefit from experiencing new technologies and products. There has been a lack of research in the usability of interactive technologies with regard to people with special education needs. Usability data collected from studies about tablet applications may provide some useful information for special education field.

Special education teachers have the critical missions for individuals and parents. Teachers' approaches towards technology exposes their education perspectives. Therefore, technology related characteristics of teachers and perceptions toward the use of tablets in education provide useful information for both of these roles. Even

though the results of experiments show that tablets are useful tools for special individuals, if teachers do not integrate tablets to learning environments, it would be hard to utilize them in special education. For this reason, it is very important to determine the special education teachers' view about tablet application examined in the study and their views about tablet usage in education.

To sum up, in special education, for the reason of individual differences of students with special needs, individual training according to students' special needs is very important. In other words, it is needed to have different instructional methods enhanced with technology and materials to improve abilities of students with intellectual disabilities. Mobile technology supported special education is necessary because using tablets or mobile phones may help to increase students' motivation and attention. In addition, technology use also affects teachers in a positive way by increasing their motivation and decreasing their workload. Therefore, there is an apparent need for this study, which is examining the effects of a tablet application on teaching daily living skills to individuals with intellectual disabilities.

1.5 Research Questions

The study focuses on the following research questions and sub questions:

Research Question 1: Does the educational tablet application contribute to learn daily living skills for individuals with ID?

Sub-question 1.1: How is the persistence of the newly learned skill at one, three and four weeks after training finished?

Sub-question 1.2: How successful is the generalization of the newly learned skill in different tools?

Research Question 2: What are the usability issues of the educational tablet application for individuals with ID in terms of effectiveness, efficiency and satisfaction?

Research Question 3: What are the views of special education teachers about the utilization of the educational tablet application? What is the graded rate of special education teachers' satisfaction about the educational tablet application?

1.6 Definition of Terms

This part aims to present definition of terms, which are used in the current study. Definitions are given by considering their operational functions within the study. In other words, definitions given below are operational definitions of terms reflecting how they are utilized or considered within the study.

Generalization: The ability to applying suggested causal relationships to different tools or environment.

Intellectual Disability (ID): Through this study, definition proposed by AAIDD (2010) is used.

> Intellectual disability is a disability characterized by significant limitations in both intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills (AAIDD, 2010).

Mobile Technology: Portable devices, software, tools and many other things those help people to conduct, create and understand actions, procedures for what they try to do.

Special Individual: A person who have disability or disabilities needed to be educated privately.

Special Education: An education type, which is prepared and arranged for specific needs for people who have disabilities.

Special Education Teachers: Special education teachers are defined as a group whose main responsibilities are teaching people with disabilities.

Maintenance: The ability that students can protect newly learned skills at one, three and four week after training finished.

Sweeping Carpet with Vacuum Cleaner (SCV) Application: A tablet application, which is used to teach sweeping skill using vacuum cleaner to individuals with intellectual disabilities.

1p36 Deletion Syndrome: A disorder that typically causes severe intellectual disability. Most of the affected individuals do not speak, or speak only a few words.

1.7 Organization of Study

In the present study, there are five main chapters, which are introduction, literature review, methodology, results, and, discussion and conclusion. In the introduction chapter, background of the study, the problem statement, the purpose of the study, the significance of the study, research questions and definitions of terms are presented in detail.

Literature review is the second chapter where the current literature is reviewed and related studies are summarized under six main headings: definition of intellectual disabilities (ID), characteristics of individuals with ID, individuals with ID and development of daily living skills, technology usage in special education and usability. Finally, implications of literature are tried to be clarified.

The third chapter is methodology, which includes introduction, overall design of the study, sampling, requirements for participants, environment and equipments, description of the mobile SCV application, the target stimulus, implementation process, data collection procedure and instruments, pilot study and data analysis procedure titles.

In the fourth chapter, which is results, findings of the conducted study are presented. Results reveal that demographic information of participants and parents, effectiveness data, maintenance and generalization data, reliability data, social validity data and usability data.

Finally, in the last discussion and conclusion chapter, results of the study are discussed and interpreted in conformity with the literature. Suggestions and implications for future research studies are presented.

CHAPTER 2

LITERATURE REVIEW

This chapter analyzes, synthesizes and summarizes the relevant literature regarding the research questions proposed in the previous chapter. This chapter presents a definition of intellectual disability (ID) and the characteristics of individuals with ID. It also explores how the daily living skills affects the life of individuals with ID and presents a general review of interventions for teaching daily living skills to these individuals. Then, the studies about technology usage in special education are presented in this part. Computer-based instruction, mobile devices-based instruction and tablet-supported instruction for individuals with disabilities is explained and studies about these topics are presented. In addition, studies about special education teachers' approaches to these technologies are also displayed.

2.1 Definition of Intellectual Disabilities (ID)

Over the past 50 years, the definition of ID has become different along with the terminology. In recent times, the American Association on Intellectual and Development Disabilities (AAIDD) has defined ID as follows:

"Intellectual disability is a disability characterized by significant limitations in both intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills. This disability originates before the age of 18" (2010, p. 1).

Three important factors are formed the definition of ID: (a) intellectual abilities; (b) adaptive behavior; and (c) age of onset. Despite the fact that the term and definition

of ID have changed over the last years, the definitions have consistently included these key criteria (AAIDD, 2010), which are clarified as follows:

2.1.1 Intellectual Abilities

Intellectual abilities require different intangible abilities such as reasoning, problem solving, planning, and thinking (AAIDD, 2010). Usually, these abilities are evaluated by using standardized intellectual tests, which helps to make comparison one's score to the mean scores of other people. When an individual scores are below two standard deviations [approximately below Intellectual Quotient (IQ) 70 to 75] on a standardized intellectual test, the individual meets the criteria of AAIDD to be identified medical condition as an individual with ID (Hardman, Drew & Egan, 2007).

2.1.2 Adaptive Behavior

Adaptive behavior is explained as conceptual, social, and practical skills that individuals need to learn for facilitating their daily lives (AAIDD, 2010). Adaptive behavior scales, are used to measure adaptive behaviors. In the scope of scales, interviews and observations are used to assess an individual's abilities for conceptual, social and practical skills (Hardman et al., 2007).

2.1.3 Age of Onset

ID is classified as a developmental disability, because it includes mental and/or physical impairments. For this reason in defining ID, age 18 was regarded as a cutoff point of onset. Individuals are diagnosed at birth or during childhood to the end of adolescent years. Developmental disabilities restricted several critical life activities such as self-direction, mobility, and language (Hardman et al., 2007). However, in order to apply this definition, the AAIDD (2010) revealed that it is important to consider the following five assumptions:

(a) Limitations in present functioning must be considered within the context of community environments typical of the individuals' age peers and culture; (b) valid assessment considers cultural and linguistic diversity as well as differences in

communication, sensory, motor, and behavioral factors; (c) within an individual, limitations often coexist with strengths; (d) an important purpose of describing limitations is to develop a profile of needed supports; and (e) with appropriate personalized supports over a sustained period, the life functioning of the person with ID generally will improve. (p. 7)

2.2 Characteristics of Individuals with ID

Individuals with ID demonstrate a large spectrum of characteristics that affect their daily lives. These can be classified as lack of adaptive skills, low success in education, delayed speech and language development, lack of self-regulation, and abnormal physical development (Goo, 2013).

2.2.1 Lack of Adaptive Skills

Adaptive skills direct attention to skills, which are essential to live in community settings (AAIDD, 2010). Some examples of these skills contain interacting with others, satisfying the requirements of the environment and taking care of personal needs (Thompson, McGrew & Bruininks, 1999). Individuals with ID have problems not only with getting these skills but also with applying them to their particular situations.

2.2.2 Low Success in Education

Roberts and Zubrick (1992) exhibited that individuals with ID showed lower academic success in general as compared to their peers without ID. Especially, this lower achievement affects both reading and math skills. Studies demonstrated that the reading fluency of individuals with ID is below their mental-age level (Kaiser & Grim, 2006) and that they perform inadequately on reading comprehension (Drew & Hardman, 2007). In addition, studies have showed that individuals with ID cannot appropriately take advantage of cognitive strategies while they are solving mathematical problems (Butler, Miller, Lee & Pierce, 2001; Parmar & Cawley, 1991). Moreover, although individuals with ID may perform simple calculations,

they may have problems while applying math concepts to real-life conditions (Beirne-Smith, Patton & Kim, 2006).

2.2.3 Delayed Speech and Language Development

Other important properties of individuals with ID are delayed speech and language development. In spite of the fact that the exact types of these delays are mainly related to the causes of individuals' disabilities (Abbeduto et al., 2006), the difficulties usually comprise articulation problems and language comprehension and production problems (Hallahan, Kauffman & Pullen, 2011).

2.2.4 Lack of Self-Regulation

Self-regulation is a significant factor about the ability to control one's own behavior (Shonkoff & Phillips, 2000); this ability is strictly related with meta-cognition, referring to an individual's consciousness of which strategy is required to solve a problem, how to use the strategy properly, and observing whether the strategy works well (Sternberg, 2003). Individuals with ID have no ability to develop and/or efficiently use self-regulation strategies needed in particular conditions (Hardman et al., 2007).

2.2.5 Abnormal Physical Development

Although there is no significant difference in physical appearance between individuals with ID and their peers without ID. Studies exhibit that there is a relationship between physical abnormalities and the severity of intellectual disabilities (Drew & Hardman, 2007). Hardman et al. (2007) stated that individuals with profound and severe intellectual disabilities have physical differences caused by genetic factors such as Down syndrome and Fetal Alcohol Syndrome. While on the contrary, individuals with moderate ID usually do not have significant physical abnotmality because the intellectual problems are inclined to be associated with environmental factors rather than genetic factors.

2.3 Individuals with ID and Development of Daily Living Skills

Individuals who are affected by intellectual disabilities to acquire new skills depends on effective teaching and functional utility skill preferences of teachers for them. When goals are determined for individuals with ID, they must be included skills and concepts which most useful according to their needs (Başal & Batu, 2003). For generating a functional program, as a priority it must be given much importance to the goals, which facilitate independent living instead of traditional academic or developmental goals (Tekin, 2000).

Researchers explain daily living skills as those skills that are required to live independently in everyday life such as shopping, cooking, housekeeping and organizing environment (Mastropieri & Scruggs, 1994). This definition emphasizes the importance of the fact that obtaining daily living skills is a significant step toward independent adult life for individuals with ID. Studies reveal that individuals with ID have much more difficulty making the transition from high school to adult life than their peers without disabilities (Affleck, Edgar, Levine, & Kortering, 1990). Several studies indicated that individuals with ID are exposed to unemployment or under-employment, low salaries, temporary rather than permanent jobs, quick job changes, segregation from the community, and difficulty establishing independent living (Halpern, 1993). Link (2008) explained that these upsetting results are directly related with the individuals' expertise in daily living skills, and that enhancing these individuals' daily living skills may cause better life results.

Many individuals with severe ID experience deficits in daily living skills, which may limit independent functioning in their natural environments and may have negative effects on their overall quality of life. In fact, individuals with severe ID may be able to obtain desired living and working opportunities if they can complete various daily living skills independently (Goo, 2013).

Especially, one of the important daily living skill for better life outcomes of individuals with ID is house cleaning such as sweeping carpet with vacuum cleaner. When individuals with severe ID are able to care for their living environments (e.g., do laundry, maintain a clean living environment), it improves their self-

determination and self-regulation, also may vary their choices for living environments. For this reason, being able to complete this skill (using vacuum cleaner) could lead to greater independence in the future and it may also increase the initiative and lead to learn new abilities (Cannella, O'Reilly & Lancioni, 2005).

Morse and Schuster (2000) suggested three reasons for why using a vacuum cleaner skill is important for improving the prospects of independent life for individuals with ID: (a) using vacuum cleaner skill is required to be taught in school curricula; (b) acquisition of these skills allows individuals with ID to acquire self-confidence and achieve self-awareness and independence; (c) this skill provide various opportunities for individuals to acquire many other skills such as problem solving skills and motor skills.

However, some particular characteristics of people with ID make difficult to learn the skill of sweeping carpet with vacuum cleaner. Spitz (1979) explained that individuals with ID live problems while utilizing conceptual strategies such as (a) grouping or restructuring information for solving problems and completing tasks; (b) using these strategies efficiently in particular conditions; (c) transferring acquired skills across novel situations; and (d) responding properly to changing situations. These difficulties are got worse due to different distractions in community (Morse et al., 1996). For this reason, effective intervention methods for teaching daily living skills to individuals with ID need to be identified in research studies. In literature review, some techniques and strategies are explained for teaching life skills to individuals with ID. Studies indicate that a range of interventions can be used effectively to teach daily living skills to individuals with ID. Especially, it is important to use systematic interventions to teach daily living skills to individuals with ID (Wheeler et al., 1980). In this study, technology supported intervention was used to teach daily living skills to individuals with ID.

2.4 Technology Usage in Special Education Field

Technology has the potential to improve education for all individuals. Technology helps to produce new methods of learning and teaching (Bertini & Kimani, 2003) and gives special individuals chance to engage in simulations, basic drill and

practice, communication or exploratory activities, which are suitable to their individual needs and abilities (Edwards et.al., 1995). In addition, technology usage in special education can supply meaningful learning experiences to improve higher order thinking skills such as problem solving ability and critical thinking skills. The successful and appropriate integration of technology into learning environments has the potential to be useful for special individuals (Martin, 2004).

2.4.1 Computer-based Instruction

Individuals with intellectual disabilities generally exhibit higher-level performance and give attention to multimedia while studying with them than they normally exhibit (Hasselbring & Williams, 2000). Computers help to draw the attention of individuals with special needs and get them to focus on the tasks to be performed in the education of these individuals (Fernández-López et al., 2013).

Computers' mechanical advantages to store, use and recover high volume of knowledge, moving visual materials make them attractive for individuals with autism (Yee, 2012). For this reason, many special education experts and teachers take the advantages of computer technology for supporting the education of individuals with autism.

Computer technology usage in special education field is not a new idea. For example, Goldenberg (1977) examined the uses of computer for communication purposes in the education of 10 multiply handicapped children with serious communication problems (such as deafness, ASD etc.). He reported that computers are as beneficial devices for these special children that can improve their quality of life, stating, "if you can control a computer, you have a powerful tool for communication and access to vast range of valuable educational, vocational and recreational activities" (Goldenberg, 1977).

An important increase has occurred in the number of computer-supported instructions in special education field in the past 10 years (Hourcade et al., 2012). Computer based interventions, which work with desktop computers, or laptops help to get positive results in different lessons such as encouraging vocalizations, building

vocabulary and learning about appropriate forms of communication (Hourcade et al., 2012). While popularity of computer applications usage in special education is increasing, families told their own experiences about the benefits of computers in teaching individuals with ASD (Ploog, Scharf, Nelson & Brooks, 2013). Ploog et. al (2013) made a search by using PsycINFO with keywords ‘‘autism’’ and ‘‘computer’’ to identify the number of publications in peer-reviewed journals for the time span of 1970–2011. As shown in Figure 2.1, until about 1981, the number of publications per year was either 0 or 1. Then a big increase occurred (to about 5–7 publications per year). Note that in the early 1980s, personal computers became more readily available. The next clear increase in publications began in the mid to late 1990s, with a trend that has continued until today. Note that in the 1990s, the Internet was popularized with the web browsers.

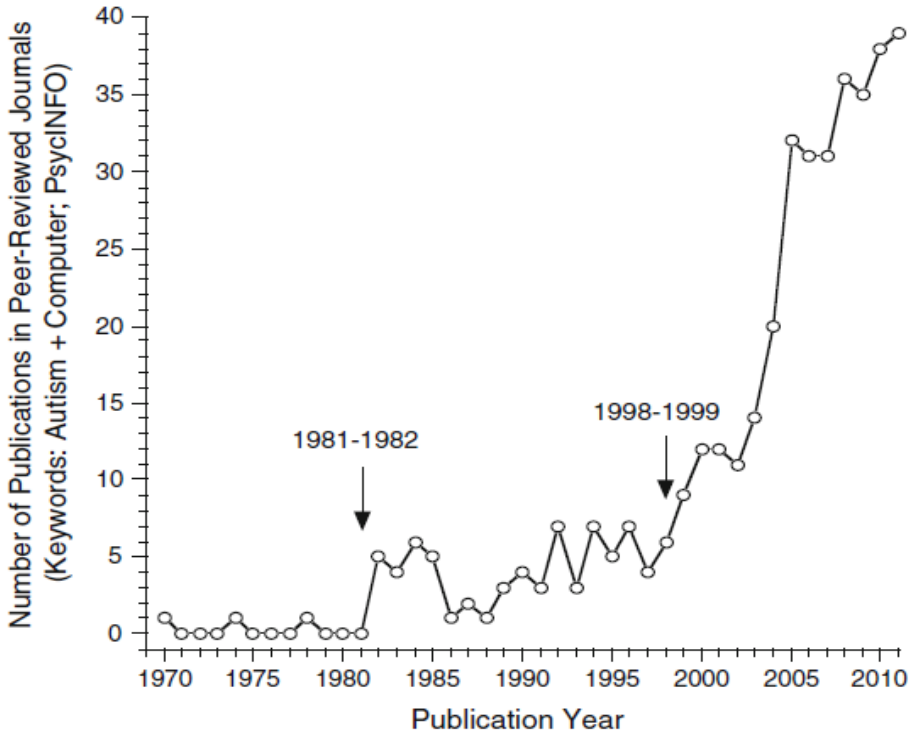


Figure 2.1 Number of publications in peer reviewed journals with keywords “autism + computer” for the time-span 1970-2011 (Ploog et al., 2013)

2.4.2 Mobile Devices-based Instruction

Mobile devices can offer people with special education needs different kinds of help (Upadhyay, 2006): helps to perform functions in daily life activities for communication, for supporting them in the education, and furthermore for assisting (Fernández-López et al., 2013). Dillenbourg (1999) stated that mobile learning is a successful model that uses educational methods supported by mobile devices that supply independence and ubiquity, and additionally enable interactions among participants through the connectivity capability of devices. Brown, McHugh, Standen, Evett, Shopland and Battersby (2011) explained that the use of mobile devices can increase quality of life and independence of people with ID.

2.4.2.1 Main features of mobile devices

Main features of mobile devices are as following (Fernández-López et al., 2013):

Touch screen: Children like to be in contact with things physically and this behavior needs no learning. Furthermore, many individuals lack the capabilities to study with a stylus, mouse or keyboard. This causes this device to be a good alternative for individuals with intellectual disabilities.

Mobility and design: Needed portability can be achieved using mobile devices. Furthermore, it is easier for users to work with mobile devices because of their simple design. Additionally, the features like GPS and digital compass allow to determine the position and orientation of the user. This contextual information gives a great opportunity to make decisions. Users can perform activities anywhere and anytime if they can be mobile. The main advantage of connectivity and mobility supplied by those devices for disabled people is that they can be constant "companion" (Bertini & Kimani, 2003).

Interaction through motion: An accelerometer can detect movement in a physical environment. For a mobile device, an accelerometer can be used to identify the change of rotation and display orientation. Vibrations and rotations can also be used as user inputs for activities developed for mobile devices.

Accessibility: Mobile devices have features like gesture-based screen reader, zoom and high contrast function.

Connectivity: Devices supply peer-to-peer connectivity that is very useful for group work. Peer-to-peer connectivity can be supplied through technologies like Bluetooth or Wi-Fi network. Disabled users can always keep mobile devices with themselves and communicate using those devices (Bertini & Kimani, 2003).

Ease of acquisition: It should also be investigated how easy the devices can be acquired by educators and parents.

Using mobile devices and multimedia makes learning more interesting and entertaining. For individuals with disabilities, personal learning practices should be prepared for their special needs. Therefore, educators frequently prefer to make interactions during the learning process as experts to improve the development of their individuals' skills. Fernández-López et al (2013) stated that educators must prepare exercises to be carried out, personalize them, and supervise and guide individuals while they undertake them. The mobility feature of the devices makes it possible to do exercises anytime and anywhere. Hence, stakeholders of the exercises can better involve in the learning process and the socialization of the individuals (Fernández-López et al., 2013).

Recent capabilities supplied by mobile devices have made new possibilities available for children with ASD. Mobile devices are used as an augmentative and alternative communication tool that can easily be carried with. Mass variety of multimedia content prepared for mobile devices and flexible storage, portibility, mobility and affordability features cause mobile devices to gain popularity. The touch screen interface makes mobile devices very easy to use. Mobile devices are also more frequently used to support individuals with ASDs in their social interactions (Hourcade et. al., 2013).

Using mobile technologies to help for communication is an important benefit of them. In a study of Madsen, el Kaliouby, Goodwin and Picard (2010), mobile devices running special software are used to detect and classify emotions on human

faces. In another study, Tentori and Hayes (2010) used mobile devices to help individuals on social activities in controlled environments like school.

Another sample usage of mobile devices was supporting activities in school and other controlled environments by Tentori and Hayes (2010). Another sample usage is speech-generating devices those use text or picture communication symbols, and they usually cost high, however, they have proven themselves in some studies (Binger, 2008).

Monibi and Hayes (2008) discovered a mobile communication tool called Mocoto for children with special needs. They investigated new mobile device technologies like "capacitive screens on many small touch-screen devices" which can be used as an alternative way for interaction. Mocoto is run on Nokia N800 cell phone that is a portable device. Users can easily interact with the big library of images those come preinstalled in Mocoto through touch screen. Mocoto allows users to add personal images to the system.

In another research, Marks and Milne (2008) suggested the use of iPod to improve the individuals in a special developmental school. The main goal of the study was to investigate the potential of new technologies, especially the iPod, on education. Most of the individuals participated in this study had autistic spectrum disorders. The devices are loaded with contents like "photos for personal self-esteem and social cognition; movies featuring the student as social scripts to demonstrate and reinforce appropriate behaviors; the use of pictorial symbols for coin recognition, days of the week, and daily activities (such as timetabling); and pictorial symbols, photos and videos to improve cognitive skills, such as classifying and categorizing" and those contents are used by individuals for learning under the supervision of teachers (Marks& Milne, 2008; p. 173).

2.4.3 Tablet -based Instruction

ICT is more accessible with tablets anymore. Interacting with computers is easier with tablets because of their portability and touch screen feature (Hourcade et. al., 2013). Tablets provide advantages like inspiring pro-social behavior through an

interactive screen, which are also supported by tabletops but with disadvantages on flexibility, mobility, availability and cost (Hourcade et al., 2012). Social behaviors like sharing the device with a partner is also possible tablets. Tablets usually have better features than mobile phones like larger touch screens and thinner structure.

Tablets have real potential also for people with ASD. Communication, social interaction, and symbolic or imaginative play are the skills that ASDs usually face difficulties (American Psychiatric Association, 2000). Functionalities supported by tablets like reading books, surfing the web, interacting with people online can help development of abilities of an autistic individual. Touch screens allow development of applications with easy to use and easy to learn interfaces (Holstein, 2012).

Hourcade and friends (2013) studied on using tablets on children with ASDs. They used applications from Open Autism Software that use collaborative and expressive activities to encourage positive social relation. They compared results from activities without the applications to results from activities with the applications. They recorded video of the activities and noted children's behavior. The result from the study was that in the activities with applications children interacted more verbally and they were more involved in the activities. The study also showed that children behaved more encouraging in the activities conducted with two specific applications. The results prove that the tablets with correct applications can help improve positive social interactions in children with ASDs.

Video modeling is recently accepted as a technique to help children with ASDs to acquire imitation. In a study, Cardon (2012) investigated to see the effect of Video Modeling Imitation Training (VMIT) implemented by caregiver via iPad. In the study, the imitation skills in children with ASD were increased. Additionally, language development after exposure to VMIT was also analyzed. Multiple implementations for four different caregivers and their children with ASD were developed. The study showed that all the caregivers succeeded to create video models on their tablets after just a minimal training, and they all implemented VMIT with a high accuracy for their children. Imitation skills of all the children improved during those specifically implemented treatments. Moreover, imitation skills were

exposed to post treatment and they were generalized to real models. All four children gained improvement also in expressive language skills (Cardon, 2012).

Fernández-López et al. (2013) designed an application named Picaa for mobile devices with touch screen to cover preparation, use and evaluation phases of learning process. The educational activities the application includes are exploration, association, puzzle and sorting. The application allows educators to personalize contents and user interfaces of those activities according to needs of children. A pre-experimental study was made on the use of Picaa by 39 students with disabilities from Spain. The results from the study were evaluated based on pre-post testing. The study showed that the use of Picaa improved basic skills like autonomy, environmental awareness, language and math, and it had positive effects on the development of learning skills for individuals with special education needs. Furthermore, activities those were not suitable for them have become accessible to them with touch screen devices, because those activities are designed specifically according to their needs. It is also inferred from the study that types of activities in the application are appropriate for education needs of students with disabilities. The study also showed that students' attention and involvement could be increased during the learning process with the help of mobile touch devices and multimedia contents (Fernández-López et al., 2013).

In his study, Harrel (2010) reported that a mother's feelings about tablets' impact on her son were positive. Her son is a young child with ASD who shows typical symptoms on verbal skills and aggressive behavior. After a working period with tablets, the mother realized that her son started to behave more independently. He started to do things that he was not capable of before and his aggressive behaviors reduced (Harrel, 2010).

In another report, Seshadri (2012) suggested to use tablets to improve communication skills of kids with ASD. In Seshandri's study, tablets helped Sharia, a two years old kid with ASD, to speak. Sharia was struggling with communication even after behavior and speech therapies. With the help of tablets, Sharia can now speak slowly and interact with the world outside of her (Seshadri, 2012).

Hourcade et al. (2013) expressed that there is not enough empirical data showing benefits of specific design or use of tablet approaches for children with impairments. Tablets allows children with impairments to interact more easily, moreover tablets can support them for improving their skills in areas they need (Hourcade et al., 2013).

2.4.4 Teaching Daily Living Skills via Technological Devices

Daily living skills are one of the most crucial potential children with impairments need to improve, because they directly affect the development of capabilities like autonomy and self-determination. Computer oriented methods have been used to improve daily living skills in several studies.

Kimball, Kinney, Taylor and Stromer (2004) developed a computer-based activity plan and applied it to a child with ASD. They saw that the child succeeded to complete the activities. Another research is studied on several young children between ages 7 and 9. In the study, a computer application that simulated daily life activities like cooking soup, making sandwich and preparing the table is used (Ayres, Maguire & McClimon; 2009). In the application, the children were expected to modify the images of real life items on the computer screen. The study showed that children improved their skills they studied using the application and were able to use those skills in real-life. Moreover, the children were able to use those skills during the following two weeks.

Van Laarhoven et al (2009) made a study using iPod on an individual with 1p36 Deletion syndrome at age 17. The individual was expected to accomplish the tasks cleaning the floor, bathroom and kennels in an animal shelter. A multiple-probe across tasks design was employed with baseline, video prompting, and follow-up phases. The individual was expected to complete the task without prompting, reinforcement and using the iPod in the baseline phase. The trainer performed a step if the participant could not correctly complete it in 5 seconds. During the video prompting phase, it was told to the individual which task he was expected to complete, and he was given the iPod to use independently. The video prompt caused increase in the participant's performance. A success criterion is defined as at least

85% correct for at least three following sessions. The participant completed four sessions for all tasks satisfying the success criterion. A follow-up session of ten weeks was carried out for the first task and it was seen that the performance was satisfactory at 89% correct. When the videos were shown, an improvement in participant's independence has been achieved as it could be inferred from the decreased number of prompts given. During completion of the tasks, it was seen that the participant was using the narration as an audio prompt. It was inferred from the results of the study that iPod with audio and video prompting tools could support improving successful task completion capabilities in an employment environment (Kagohara, van der Meer, Ramdoss, O'Reilly, Lancioni, Davis & Sigafoos, 2013).

Burke, Andersen, Bowen, Howard and Allen (2010) made two studies to investigate the benefits of iPhone and iPod Touch to develop employment skills. In the studies, six persons with ASD between ages 18 and 27 years were taught to respond correctly in a fire safety-learning program. The education program trainer interacted with the participants to get 63 written responses from them. In the study, a cueing system was developed for iPhone and iPod Touch wirelessly connected to each other. The instructor was able to send prompts using iPhone, which had the capability to send prompts for each 63 different steps to iPod Touch. Burke et al.'s (2010) used three individuals between ages 20 and 27 years in their first study. A training video created and a scripted behavioral skills training program constituted the training. The cueing system was used only when the individuals could not complete a session with at least 80% correct responses. The training and the cueing system were evaluated using a multiple baseline across participants and reversal design. Baseline, behavioral skills training, cueing system, follow-up and generalization probes were implemented. Success criterion was reached by one of the participants after only the behavioral training and was maintained on follow-up and generalization probes. Nevertheless, for the other participants the cueing system was used. One of these participants succeeded training just with the help of the cueing system. The last participant succeeded the training after the all sessions including the cueing system. The performance of the participants decreased when the cueing system removed from the training, and after inclusion of the cueing system, the performance improved again.

The participants maintained their performance on follow-up and generalization probes.

The second experiment in the study made by Burke et al. (2010) investigated the cueing system's influence on development of employment skills. Additional three participants between ages 18 and 20 years with ASD were used with the same activities in the first experiment. The success of the cueing system was examined by a multiple baseline across participants and reversal design. Additional training was given to the participants when they could not succeed the expected tasks after the second session. Furthermore, the correct responses were approved by verbal praises and wrong responses were corrected using live modeling and practice sessions. When the cueing system was used, two participants were able to complete the tasks successfully. Restoring initial status of the baseline procedures caused the performance to decrease, because the third participant was not able to succeed the tasks with the cueing system. However, the participant was able to reach the success criterion when the behavioral skills training were added. Performance was decreased when the procedures were reinstated. When the cueing system was added again, participants reached the success criterion and they were able to keep this performance in follow-up and generalization probes. These two experiments show that cueing system using an iPhone and an iPod Touch was an efficient design to prompt in an employment setting when prompts are needed to be delivered remotely (Kagohara et al., 2013).

Stromer, Kimball, Kinney and Taylor (2006) suggest that so-called ‘‘activity schedules’’ (a notebook—possibly computer-based—using pictures, symbols, and/or text to guide an individual through specific sequences of daily activities) can be combined with other computer based technology to promote social skills in individuals with ASD. Reviewing the literature, Stromer et al. (2006) suggest that such a combination may be effective in part because it allows for the easy pairing of visual and auditory stimuli, thus providing training in attention to multiple cues, which poses a problem for many people with ASD who often have difficulties attending to multiple cues.

Kimball et al (2004) provide a description of a case study used to explore a combination of CAT with activity schedules to enhance social skills. These authors worked with a 4-year-old boy with ASD using a computer, video models, and computer-presented activity schedules. In this case, the approach proved to be effective in teaching the child age-appropriate social skills. The use of a computer was considered beneficial because of the efficient and consistent delivery of instructions and reinforcement contingencies, and because it promoted the combined use of audio and visual cues (Stromer et al., 2006).

Similar to Kimball et al. (2004), in another case study, Dauphin, Kinney and Stromer (2004) combined activity schedules and video-based CAT to teach social skills and socio-dramatic play skills to a3-year-old boy with ASD and attention deficit/hyperactivity disorder. The boy improved his social skills, and his improvements generalized somewhat to activities not specifically trained.

2.4.5 Technology supported Instruction and Special Education Teachers

The primary role of teachers in special education schools is to introduce and familiarize their individuals to the various intellectual aspects of the world around them (Nam, Bahn & Lee, 2013). Therefore, special education teachers and specialists' approaches to assistive technologies (AT) are very important. Research studies on technology use suggest that to be used effectively and successfully, teachers must have the knowledge of skills to use and understanding of technology to use it individuals with disabilities (Flanagan, Bouck & Richardson, 2013).

Teachers reported barriers to using assistive technology in education including cost, usability, and lack of training/ experience (Flanagan et al., 2013). Firstly, a barrier to using AT is a lack of knowledge about how to use it as well as about types of AT. While in-service special education teachers may have had AT coursework during their undergraduate or graduate education, few workshops or professional development opportunities exist outside of coursework to continually support teachers' use of AT during instruction (Derer et al.,1996; Lee & Vega, 2005; Ludlow, 2001; Michaels & McDermott, 2003 as cited in Flanagan et al., 2013). Second barrier to using AT can also be high cost to purchase and upgrade. Funding

issues can prevent teachers from getting access to and using various tools. Another barrier is related with usability. Usable products facilitate to use of technology in special education.

Nam et al. (2013), tested hypothesized relationships among key determinants of AT acceptance such as the facilitating condition, perceived ease of use, computer self-efficacy, result demonstrability, perceived usefulness, and behavioral intention. Results from analysis of data collected from a number of special education teachers in schools for the visually and/or auditory impaired confirmed the effects hypothesized in conceptual model of AT acceptance. In particular, perceived usefulness was a dominant factor affecting AT usage.

2.5 Technology Usage in Special Education Field: Turkish Literature

The research studies done in Turkey about the technology usage in special education field were presented in below. Studies are summarized according to topics under the six different titles. These are: (1) Computer- based education, (2) Video modeling, (3) Teachers/parents views or attitudes about technology usage, (4) Mobile technology supported education, (5) Usability, (6) Other technologies (Game, web-based materials etc).

2.5.1 Computer-based Special Education in Turkey

The studies carried out in Turkey about the effectiveness of computer-based education in the field of special education were presented in this part.

Başoğlu (2009) developed educational software, which teaches "Qualification Concepts" for increasing effectiveness and productivity in order to supply for the education of mentally disabled students. In research, multiple baselines between subjects design was used. The dependent variable is success and operation time. The independent variable is education method. In this process, control group got traditional teaching while experimental group was taught by using computer-assisted teaching methods and the results were recorded in “observation form”. According to results of the study, both experimental group and control group improved their

learning. However, computer-based education was much more interesting and simple; also, its learning process was shorter than the traditional education.

Dalgın-Eyiip (2011), investigated the effects of video-enhanced activity schedules instruction on the computer on the acquisition, maintenance and generalization of schedule following and pretend play skills of children with ASD. Three male children and one female child with ASD whose ages ranged from five to eight participated in this study. Functional relationship was established by using the multiple probe design across subjects design. The findings of the study showed that video-enhanced activity schedules instruction on the computer was effective in teaching the schedule following skill as well as three pretend play skills (teatime, barber and train) to four children with ASD participated in the study. Moreover, the schedule following and pretend play skills were maintained and generalized across different settings and materials as well as the schedule following skill was generalized from the computer activity schedule to the notebook activity schedule.

Tanju (2004), investigated the effects of computer aided education on the acquisition of shape, color and number concepts by mentally handicapped children between ages of 4-5. The sample of the study was 27 mentally disabled children at a developmental level of 4-5 years. Experimental research design was used in the study. Computer assisted education program applied to the experimental group. Because of statistical evaluation for shape, color and number, it was found that the difference between cognitive processes of the experimental and the control group was significant.

Aruk (2008), investigated the effectiveness of computer based training in the education of mathematical concepts (summation, subtraction etc.), colors to students with intellectual disabilities. Experimental research design was used. Ten students with intellectual disability joined the research. Experimental group used information technologies (computer, projection and Moodle) and control group used classic methods (blackboard). According to results of study, there was no significant difference between two groups in terms of academic achievement.

Kanpolat (2008), investigated the effectiveness of simultaneous prompting procedure presented by computers on identifying the items of clothing for individuals with

characteristics inherent in autism. The experimental design of the study was multiple probe design across three subjects who were students between 8-12 years of age with characteristics of autism. Five items of clothing were taught to each subject in the study. The dependent variable of the study was the behavior of pointing to the right item of clothing by touching the screen by hand or finger. The independent variable of the study was the use of simultaneous prompting procedure presented by computers. The findings of this study showed that simultaneous prompting through computers was an effective instructional procedure in teaching the individual with autistic features to identify the picture of clothing items that were named. It was also evident that simultaneous prompting procedure was effective in maintaining what was learned 1, 3 and 4 weeks after the instruction had stopped. At the same time, the individuals in the study could generalize the skill across materials.

Özak (2008) investigated the effects of simultaneous prompting presented via computer on the reading skills of children with intellectual disability. A multiple probe design across subjects was used in the study. Six mentally disabled children participated in the study. The subjects were divided into two groups. Ten words that indicated location and direction were identified for teaching the subjects. The words which indicated direction were taught to the 3 participants in the first group by means of simultaneous prompting via computer assisted instruction; and the process were repeated by teaching the words that indicated location via the same method to the participants in the second group. At the end of the study, it was seen that simultaneous prompting presented by computer-assisted instruction was effective in the teaching of reading skills to children with intellectual disability. According to the findings of the study, it was seen that the subjects succeeded in the maintenance and generalization to at criterion level.

Armutçu (2008) investigated to the effectiveness of simultaneous prompting on teaching writing skills by using Microsoft word program to three children with mental retardation. Multiple probes across subjects design, which was one of the single subject designs, was used as the research design. The study consisted of five children who are mentally retarded. Three students of those students who committed to participate in the study were involved in treatment. One of those five was held in

the list in case of possible problem. The last one participated in the pilot study. According to the results, simultaneous prompting procedure was effective on teaching writing skills by using Microsoft word program to three children with mental retardation. Maintenance and generalization data showed that students maintained the writing skill 7, 14 and 21 day after the teaching and the writing skill was generalized to different location, tools, individuals and documents. In addition, families of children and classroom teachers offered a positive opinion toward learning writing skills by using word document via simultaneous prompting procedure.

Çatak (2006) investigated the effects of "reading material" which prepared by Power Point Presentation program on reading comprehension skills of students with intellectual disabilities. The study was carried out with three students with intellectual disabilities. AB design as a single subject research design was used in the study. Dependent variable of the study was reading comprehension skill and independent variable "reading material" which prepared by Power Point presentation program. According to results, students with intellectual disabilities can gather attention easier and for longer time in computer-supported lessons.

Uçar (2007) presented three software modules to assist the education and training of children with articulator problems, autism or mental retardation. The first module generated word lists to be used by trainers or parents in the training and/or rehabilitation of children with articulation problems. The second and third modules allowed that children who had trouble in the usage and understanding of the language to establish the bridge between linguistic expressions and the concepts they refer to via relevant images. The software have been continued to develop.

2.5.2 Video modeling in Turkey

Öncül (2015) investigated the differences between the live modeling and video modeling in terms of effectiveness and efficiency on teaching symbolic plays to children with autism spectrum disorder in small groups. The study was carried out with 3 male children with autism spectrum disorder at the age of eleven. In the study, adaptive alternating treatments design was used. The independent variables of the

study were live modeling and video modeling presented by small group instruction; the dependent variables of the study were the symbolic plays of acting as a waiter and acting as a barber. The research findings demonstrated that both live modeling and video modeling presented by small group instruction were effective in teaching, maintaining and generalization of symbolic plays to children with autism spectrum disorder. Video modeling was more effective than live modeling in acquisition phase.

Halisküçük (2007) investigated the effectiveness of video modeling to teach cooking macaroni to children with mentally retarded. To reach to this aim, prepared individualized education program was applied to three mentally retarded children. The dependent variable of this research is to provide children the cooking ability, which is essential for daily life. The independent variable of this research is education program, which is based on video modeling. The design of this study is a multiple probe design across subjects that are a model of multiple baseline design. Research findings show that video modeling to children with mentally retarded on teaching skill is effective. They can perform this after 1, 2 and 4 weeks after intervention and they generalized this skill to different tools and materials in different times and circumstances.

Gülsöz (2014) investigated the effectiveness of set an example with video method in teaching skills of preparing and presenting cold drinks to students who indicate high functioning autism property. Three students who are one male and two female at the age of 10 and 11 years old, diagnosed with autism. Multiple probes between subjects model as the single-subject research methods was used in the study. The findings of the research shows that set an example with video method in teaching skills of preparing and presenting cold drinks to students who indicate high functioning autism property has been effective, and they keep this ability after teaching.

Odluyurt (2013) investigated that whether students with autism spectrum disorder (ASD) can teach the skill of playing game with rules to their peers by using direct modeling and video modeling. Adapted alternating treatments design as a single subject research model was used. Direct modeling and video modeling methods were

taught to students with ASD. According to results, there were no significant difference between direct modeling and video modeling in terms of effectiveness.

Bozkurt (2011) investigated the effectiveness of peer video modeling and adult video modeling for teaching skills of cooking soup and first aid to students with ASD. Three autistic students joined study. Adapted alternating treatments design as a single subject research model was used. Results showed that students with ASD learned both target skills and meet the criteria level. Newly learned skills were remained after the treatment and students generalized the newly learned skill to different environments and tools.

Genç (2010) carried out the study with four students with ASD. Adapted alternating treatments design as a single subject research model was used. Food preparation skill was taught by using video modeling method and traditional method. Results showed that there was no significant difference between two methods.

Değirmenci (2010) investigated the effectiveness of video modeling for teaching housekeeping skill to four individuals with intellectual disabilities. Multiple probe between participants design as a single subject research methodology was used in the study. According to results, video modeling is an effective method to teach housekeeping skill to individuals with ID.

Akmanoğlu (2008) investigated the effectiveness of video modeling for teaching the ability to avoid the attempt of malicious foreigners kidnapping to three individuals with ASD. Multiple probe between participants design as a single subject research methodology was used in the study. According to results, video modeling is an effective method to teach this skill to individuals with ASD.

2.5.3 Special Education Teachers'/Parents' Views/Attitudes about Technology Use in Turkey

Karal and Çiftçi (2008) investigated that the teachers' views about computer animation which solve deaf students' understanding and comprehension problems in education life. Interviews were done and the problems were tried to find out with

questionnaire studies. At the end of the study, it has been pointed out at that deaf students' interest was high to computers and technology, in all classes computer aided education must be given and if curriculum for deaf students is done, the deaf students will be successful in lessons in lessons. Moreover, it was emphasized that the efficiency software, which should be prepared for deaf students must have visual richness, pictures presentations with animations and must include games.

Tezer and Kanbul (2009) took opinions of 6 special education centers' teachers and headmasters who related to the Ministry of Education's unit Primary School Office, about computer aided mathematics teaching. During gathering data, they applied a questionnaire to find out opinions about computer aided mathematics teaching. It has 30 items, which adapted for Special Education Centers. As a result, teachers mentioned positive results about computer aided mathematics teaching contribute disabled students.

Demirkıran (2005) determined the thoughts of professional members who worked in special education field about computer-assisted education and they examined attitudes of them according to various independent variables such as gender, age, tenure, etc. According to results, it shows that special education institutions have not enough number of computers, their hardware and software opportunities are insufficient. However, the professional members of special education who work with "auditory handicapped", "visually handicapped" and "spastic handicapped" children have positive opinion about the idea that computer assisted education applications increases students' success.

Karal, Ozlu and Kokoc (2010), investigated the opinions of teachers and parents about the applicability of online teacher-parent meetings. Two different online teacher-parent meetings were conducted during this study. Two meetings were conducted using an online conference environment that supported visual and vocal attendance for two different participant groups. It was found that teachers thought online teacher-parent meetings have advantages for both schools and parents, because of the flexibility of place and time. It was determined that parents thought

positively about online teacher-parent meetings and were enthusiastic about these applications.

2.5.4 Mobile Technology supported Special Education in Turkey

Doğan (2015) determined how a technology-enhanced extra curriculum affects students with intellectual disability in terms of cognitive and physical development; along with teachers' perceptions. The participants of the study were 58 students with intellectual disability. In line with the technology enhanced extra-curriculum, students participated in various activities, such as recording a short video, playing concept games on touch table and tablets, playing games on Xbox and drawing pictures on draw tablets . The researcher conducted interviews after study was over and observations throughout the activities were done. Moreover, a demographic questionnaire was administered to teachers. Finally, a document analysis of the drawings of students with intellectual disability was conducted with teachers. Findings from the data analysis showed that technology-enhanced extracurricular activities affected participants in a positive way in terms cognitive and physical development. However, such activities should be regular and continuous in nature, for students to get the most benefit from them. In addition to these, it was shown that teachers' perception is positive towards using technology. Finally, teachers explained that technology based extra-curricular activities should be used for supportive purposes in special education not as the core curriculum or instruction.

Acungil (2014), investigated the effects of Tablet Computer Instruction Program presented via audio-visual technologies on teaching the use of tablet computer skill. Four youths (one girl and three boys) with mild and moderate intellectual disability whose ages are between 12 to 16 years old participated in this study. Multiple probe design between the participants was used. Dependent variable of the study is using tablet computer and independent variable of the study is TACIP presented via audio-visual technologies. TACIP is an e-book material. Findings of study indicated that all participants learned to use tablet computer by meeting criteria (%85). Also, it has seen that all participants were able to maintain the acquired skills and generalized it to other tablet computers and other settings. Social validity findings of the study

were positive. Students stated that "it was marvelous to participate in this study" and parents said that "it was glad to us study with you".

Hanaylı, Serbest and Ürekli (2015) aimed to design for the individuals with autism to make their social lives easier. By developing mobile Android application, it was planned to support the learning disorders and perception problems for the children with autism. In addition, it was aimed that individuals with autism learn new knowledge by having fun. App Inventor, an online mobile software development program was used and the application was called as Fidan. Development process of application has been continued.

Kuzu, Cavkaytar, Odabaşı, Erişti and Çankaya (2014) make a research to develop mobile skill teaching software, which will be used by parents to teach daily life skills to their children with intellectual disability. Design based research methodology was utilized for the study. With this purpose in mind, first of all a pilot software was developed based on the applied behavior analysis technique and in line with the related literature. Then as a sample group, ten participants were determined. These participants used the software and tried to teach the daily living skills by using the software. Data were collected with semi-structured interviews and video recordings of skill teaching sessions. Based on the data analysis, new decisions were made about the software design and the software development process continued. The data collection and software development processes were performed in a circular process. In this study, the software development process was explained, and the software developed in this process was introduced.

2.5.5 Other Technologies (Touch table, games etc.) for Special Education in Turkey

Uzun, Gülen, Uzun, Çakır, Çağıltay, Karasu & Kaplan (2013) revealed that the potential of Kinect controlled with body movements in education for students having mental disabilities by taking to the experts' opinions who study on special education field. Grounded theory is used as a research model. Data are collected with semi-structured interview questions from eleven experts who study on students having

mental disabilities from four different universities in Turkey. In conclusion, the experts reported that Kinect technology contribute to students learning when it integrate the special education program.

Çankaya and Kuzu (2010) investigated that how children with autism interact with computer games, how computer games can be used for educational purposes, and what characteristics educational computer games should have in education of children with autism. They designed and developed educational computer games for children with autism. Design based research methodology was used to investigate the characteristics of educational computer games for children with autism.

Tezcan and Uçar (2012) aimed to increase the mathematic success of the mentally disabled children by using a Web-Assisted Distance Learning System. The study was carried out with 20 slightly mentally disabled students. These 20 students were divided into two groups, ten students in each. During the intervention, while the students of one group were given traditional education, the students in the other group were educated with interactive contents on the Web-Assisted Distance Learning System. According to results, there was no significant difference between two groups in terms of mathematic success.

2.6 Usability

In Turkey and in all over the world, the number of people called as "Disabled" is not few. 15% of people all over the world have different disabilities (WHO, 2015). According to Turkish Statistical Institute (2002), 12.29% of the population of Turkey is disabled. In the context of fundamental rights and freedoms, people with disabilities should not live challenges to satisfy needs such as education, health, business, transport. However, they face many difficulties to access information and use technology in education field.

Individuals' acquisition of skills and content knowledge can be enhanced by using technology if the technology is used to deliver well-managed and well-designed instruction. Usability studies are essential to produce design principles or well designed materials for people with disabilities. In this section, definition of usability,

usability for special education individuals and usability evaluation methods are presented.

2.6.1 Definition of usability

An ISO standard made a formal and widely used definition of usability, which states: "Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (ISO 9241-11, 1998).

In addition, the ISO standard explained the main components of usability: effectiveness (measure of a task completion), efficiency (measure of a task time), satisfaction (a subjective measure of users' experience) (Çağıltay, 2011). Other different quality properties of usability are memorability (can be remembered easily by a random user), learnability (can be learned easily by a novice user), and error rate (can be fixed few and easily repairable errors) of the product (Nielsen, 1993).

2.6.2 Usability Studies about Special Education

The varying needs of individuals with intellectual disabilities require the use of different methods and products in the special education field. Technologic developments are known to provide potential solutions for students need special education. Especially, multimedia technology has many useful properties for special education field. Multimedia software is defined as an integration of multiple elements (text, graphics, video and sound) in an application; it addresses more than one sense of the user (Akkoyunlu & Yılmaz, 2005). Designing and making usable multimedia gives individuals a real sense of achievement. Well designed, usable materials can support to improvement of student learning.

Harrysson, Svensk and Johansson (2004) studied with seven participants with cognitive disabilities when they visited and navigated between different web sites by using a web browser. Participants' ages ranged from 15 to 44. They were given many web navigation tasks on pre-determined web pages. Findings recommended that the participants were expert at web site navigation. They used hyperlinks easily and the

forward/back buttons without trouble. Nevertheless, participants lived problems while using text input tool and writing an URL or a search data. The researchers inferred that the text processing may prevent or delay internet accessibility of individuals with cognitive disabilities. They adviced that these needs of individuals with cognitive disabilities should be supported by text-scanning technology or screen readers.

Brown, Powell, Battersby, Lewis, Shopland and Yazdanparast (2002) make a usability study with a panel of experts to evaluate a product for individuals with learning difficulties. The researchers designed an Interactive Multimedia Learning Environment (IMLE) for socially excluded individuals. To check the usability of the IMLE, five tasks were arranged for expert panelists. The difficulties, which were living during task analyze process, were recorded. Common problems of experts were eliminated and guidelines were simplified.

William and Nicholas (2006) examined the usability of a multimedia learning environment, which designed for people with special educational needs. The researchers explained that many significant issues for investigators, designers and educators, about development of computer-based products to encourage independent learning and inclusivity. They made advices for designing to match learner needs to learning materials according to cognitive and accessibility profiles of individuals.

In the literature, there is not enough empirical usability study about people with disabilities, except concerning visually impaired people. In Turkey, also there are only a few usability studies related with special education field. Some examples were presented below.

Karal, Kokoç and Ayyıldız (2010) investigated the usability of an educational computer game. The game was built to help to improve the psychomotor skills of students with mentally disabilities. Webcam is used as an input device for providing user-computer interaction in the game. A case study research method was used in the study. There were four participants, who were two individuals with mentally disabilities, a physiotherapist and a teacher. The teacher and physiotherapist underlined that the game can help to enhance the psychomotor skills of mentally

disabled people. In summary, it can be inferred that the design and interaction attributes of game is suitable for students with special educational needs.

Demircioğlu (2011) mentioned about the term of disability, problems that people with disabilities encountered in ICT areas and some computer programs in order to find a solution to these problems. In addition, the researcher suggested the methods to solve these problems that must be followed based on the principles of "Design for All" and "Equal Access". The researcher tried to improve conscious awareness against individuals with impairments.

2.6.3 Usability evaluation methods

Usability evaluation methods (UEMs) have two main sub-methods: usability testing and usability inspection methods. Usability inspection methods have one or few experts who evaluate the usability of the product or system (Nielsen & Mack, 1994). In usability testing method, the usability practitioners observe the real users while they are using the system or product. Cognitive walkthrough, heuristic evaluation and formal usability inspection are sample methods of usability inspection. Performance measurements, think-aloud and eye-tracking are sample methods of usability testing (Pekkala, 2012). In this part, heuristic evaluation and performance measurements, which are used in the study, are presented.

2.6.3.1 Heuristic evaluation

One of the most common usability inspection methods is heuristic evaluation (or expert evaluation). Experts carry out heuristic evaluation by analyzing interface carefully and suggesting advices about the interface's good and bad attributes. Experts show how products are alike or different from some heuristics or usability guidelines, in spite of the fact that the evaluation process can be directed by using common sense and insight (Nielsen, 1993).

In special education field, Brown et al. (2011), seeks to develop of the Android application which is an accessible location-based services learning tool. Researchers also used game-based learning approaches in the application to help people with intellectual impairments. In the study, twelve international experts depicted and

examined a set of usability guidelines for each target of application. They investigated each of modules versus each heuristic. The expert team presented and organized a problem list related with heuristics according to importance and recommended advices to solve problems. General agreement between experts would be useful for the end users who are people with disabilities.

2.6.3.2 Performance measures

A great number of performance measures can be collected from a user while they are performing tasks. Nielsen and Rubin determined 18 measurable performance measurements, some of them are as following: ratio between successful interactions and errors, task completion time, number of directions or features used by user, number of user errors, and number of times user contacts help desk (Nielsen, 1993). Performance measures are commonly collected by using a stopwatch and observing users. These methods present quantifiable data and they help to analyze easily. Some studies in which usability-testing method was carried out with people with disabilities are presented:

William and Hennig (2014) conducted a study to examine one attribute of interface design. Researchers investigated that in which content arrangement individuals with learning difficulties access to content quickly in a horizontal or vertical. While users were performing tasks (finding contents or menu items), researchers observed them and calculated the task completion time. The findings of the study showed that there is no significant difference in completion time between horizontal and vertical arrangements. The content should not be fall below screen level, it is important that scrolling should not be required for easy access.

Karreman, van der Geest and Buursink (2007) made a usability test for two different versions of a web page: one of web page is based on easy-read guidelines, other web page is not adapted to easy-read guidelines. 20 individuals joined the study in each two group. In the first group, individuals had intellectual disabilities but they could read, in the second group, individuals had no disabilities. Findings of the study demonstrated that there was a significant difference between the easy-read page and

the regular page in terms of comprehension. In both of group, easy read site was better than regular page in terms of usability.

Sevilla, Herrera, Martinez and Alcantud (2007) investigated web browsing preferences and content selection of 20 participants with cognitive impairments. The researchers produced a basic web browser and two different pages: pages offered choices to user among particular alternatives and allowed the participants to browse the selected choices. Effectiveness, efficiency and satisfaction components of usability were investigated in the study. Results of the study showed that in the usable site, search performance of participants enhanced remarkably in terms of effectiveness and efficiency.

2.6.4 Mobile Technologies and Usability

The development of mobile applications adapted to individuals with special education needs causes to achieve advantages of mobility as it helps to improve the training of individuals with different intellectual, sensorial or mobility deficiencies. For this reason, it should be considered the non-functional requirements in the design of mobile products (Chung & do Prado Leite, 2009 as cited in Fernández-López et al., 2013), such as:

Usability or accessibility, designing easy-to-use applications, ensuring that users can interact with them and understanding both the tasks to be accomplished, and also the response of the system. Special emphasis needs to be placed on individuals' cognitive and sensorial functional diversity and on promoting approaches to intuitive interaction such as touch or voice.

Flexibility or adaptability supports educators to modificate personally and adapt content of product according to both user and educational contexts. Nevertheless, the customization options should be the result of an in-depth analysis of the diverse characteristics and needs of individuals.

Mobility, mobile devices have become a very useful support in constructing learning applications because they provide freedom of movement between different locations

within the school or outside. Users can always take out the application to be used when they need it.

The most fundamental difference between tablet computers and regular computers relating to usability is the input method. Directly manipulated graphical user interfaces (GUI) were the next step after command-line based interaction. With direct manipulation, users can handle files as icons, dragging and clicking them instead of writing commands in command line. Furthermore, touch screen devices take direct manipulation to another level by allowing users to touch the digital items directly on the screen itself (Saffer, 2009). This makes the interface of a tablet computer natural.

2.7 Implications of Literature Review

As presented in the literature review section of the study, mobile technology enhanced education for individuals with intellectual disabilities has great potentials. Nonetheless, there is a lack of academic study conducted about mobile technology supported special education in Turkey. It is expected that the present study can be a base for forthcoming studies to be conducted in near future.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter presents the detailed description of the research methodology, which is applied in the research study. In this section, the design of the study, sampling, requirements for participants, environment and equipments, description of the mobile SCV application, the target stimulus, implementation process, data collection procedure and instruments, pilot study and data analysis procedure are presented.

3.2 Overall Design of the Study

The present study was designed as a single-case research. Multiple baselines across subjects design was used as single case research in order to examine the effectiveness of educational tablet applications in the daily living skills education of individuals with ID. Furthermore, to identify the usability issues of educational tablet applications “expert approach – heuristic evaluation” and “experimental approach - user test” methods were used together. In the special education field, user testing method alone is not enough without experts’ view, since people with ID may live some problems to reflect their thoughts and in the each test may behave differently than before. Therefore, when expert team (usability experts and special education experts) use “heuristic evaluation” method to identify usability issues, user tests’ data may be helpful to expert team. User tests' data makes it easy to infer from behavior of people with ID.

3.2.1 Single-Case Research Design

Single-case research designs (SCRD) are a class of experimental methodology that has been utilized for decades in a number of disciplines including psychology and education (Kazdin, 1982). Other names of single case design are single subject research design and intra-subject research design. SCRD has a long tradition in the behavioral sciences. Sidman (1960) first described this research approach in his seminal book, Tactics of Scientific Research: Evaluating Experimental Data in Psychology, which exemplified its application within the context of basic experimental psychology research. In 1968, Baer, Wolf and Risley elaborated on SCRD how it could be used in applied research to evaluate the effectiveness of intervention with individuals. Since that time, many articles, books have been written about SCRD and its usage in different disciplines. Characteristics of SCRD and one of the most common designs of SCRD (multiple baseline and multiple probe designs) are presented in below.

3.2.1.1 Characteristics of Single Case Research Design (SCRD)

In spite of its name, SCRD, it is important to understand that this research approach is not a case study approach in which there is only one participant, whose behavior is described, in detail, in written narrative, based on primary data collected using qualitative research techniques. SCRD is a quantitative experimental research approach in which study participants serve as their own control, a principle known as "baseline logic" (Sidman, 1960). In single case design studies, each participant is exposed to both a "control" condition, known as baseline, and an intervention condition. The target behavior is repeatedly measured within the context of one several research designs that evaluate and control for threats to internal validity. Depending on the research design used, baseline (A) and intervention (B) conditions are slowly alternated across time (e.g., A-B-A-B or withdrawal design), or the intervention condition is introduced in a time-lagged fashion across several behaviors (conditions or participants) (Gast & Ledford, 2014). The baseline phase serves two critical functions (Kazdin, 2011). The first is referred to as the descriptive function. The data collected during the baseline phase describe the existing level of

performance or the extent to which the client engages in the behavior or domain that is to be altered. The second is referred to as the predictive function. If the intervention is not provided, the baseline data serves as the basis for predicting the level of performance for the immediate future.

Another basic requirement of SCRD is "continuous assessment" because single case designs examine the effects of interventions on performance over time (Kazdin, 2011). Continuous assessment allows the investigator to examine the pattern and stability of performance before treatment is initiated. The pretreatment information over an extended period shows the performance without the intervention. The observations are continued and the investigator can examine whether behavior changes coincide with administration of the intervention when the intervention is eventually implemented (Kazdin, 2011). The most common SCRD are the ABAB design and the multiple-baseline design.

3.2.1.2 Multiple Baseline and Multiple Probe Designs

Baer, Wolf and Risley (1968) introduced "multiple baseline designs" to behavioral researchers in their seminal article describing applied behavior analysis. It was 10 years later that Horner and Baer (1978) described a variation of the multiple baseline design that they termed "multiple probe technique". Both designs are based on the same baseline logic for evaluating threats to internal validity and demonstrating experimental control. Procedurally, multiple baseline and multiple probe designs differ in one way: the frequency with which pre-intervention data are collected. Where multiple baseline designs require a plan for the continuous measurement of all targets prior to the introduction of the independent variable, the plan for multiple probe designs is to collect data intermittently prior to the introduction of the intervention. This difference influences the experimental rigor and practically of the two designs. Both designs are, however well-suited to the practical requirements of applied research in that they (a) lend themselves to program efficacy measures, (b) have no withdrawal of intervention requirements, (c) are easy to conceptualize and implement, thus permitting practicing teachers and clinicians to conduct research in their school or clinical environment.

There are three principal variations or types of multiple baselines and multiple probe design: (1) Across several *behaviors* of a single individual or group; (2) Across several stimulus *conditions* (settings, adults, arrangements, formats, etc.); (3) Across several *participants* (individuals or groups of individuals).

In this study, multiple baseline across participants design was used. In multiple baseline and multiple probe designs across participants, the independent variable is sequentially introduced across several individuals who exhibit behaviors that occur under similar environmental conditions. The ideal or at least the more conservative research approach is to identify individuals with similar learning histories who emit the same target behavior at similar frequencies under similar pre-intervention conditions.

Baseline logic for multiple baseline and multiple probe designs across participants is similar to that is used with other multiple baseline and multiple probe designs, in that you identify a minimum of three participants who exhibit similar behaviors under similar environmental conditions, but who are independent of one another. Initially, the target behavior emitted by each of the participants is measured under pre-intervention conditions until a stable trend and level are established for each participant. Once an acceptable level and trend are established with one participant, introduce the independent variable to that participant, while continuing to measure the behaviors of other participants under pre-intervention conditions. When the target behavior of the first participant reaches your preset criterion, introduce the independent variable to a second participant whose pre-intervention data are stable, while continuing to monitor the target behavior of other participants under baseline or probe conditions. The systematic and sequential introduction of the independent variable continues until all participants have been exposed to the same intervention.

3.3 Dependent and Independent Variable

The dependent variable of the study is the skill of sweeping carpet by using vacuum cleaner. The reason for choosing this skill is that it has high probability to be used in the future. The independent variable of the study is instruction with educational tablet application.

Task analyze was done for teaching the skill of sweeping carpet with vacuum cleaner. Task analysis was carried out by observing individuals with ID while performing task during pilot study. After steps of the task were formed, one special education teacher's views were received about the tasks. According to teacher's views, required adjustments were performed. Steps of task analysis (sweeping carpet with vacuum) were presented in Table 3.1.

Table 3.1 Steps of task analysis

Step No	Tasks
1	To pull the power cord from the plug.
2	To show the socket in the room.
3	To plug in the power cord.
4	To press the power-on button.
5	To hold the pipe.
6	To sweep carpet by moving the pipe back and forth.
7	To press the power-off button.
8	To unplug the power cord.
9	To press the button to rewind cord.
10	To move the vacuum on its own place.

3.4 Participants

The subjects of the research consist of five individuals with ID recruited from a special education and rehabilitation center in Istanbul. The number of special education and rehabilitation centers placed in Istanbul is 317. Special Bilge Şirin Special Education and Rehabilitation Center has been selected for the research due to the large number of students (153) and teachers (21) and proximity to the researcher. Before starting the study, researcher meet with teachers, information about study was presented. Seven individuals who have prerequisite behaviors and were deemed appropriate by teachers and parents were selected. Two students for pilot study and three individuals for main study were selected. "The Parent Permission Form" (Appendix A) was signed by parents for the participation of the subjects. During the study, the subjects' real names were not used; predetermined code names were used. Their code names were DS, IG, OA, KE and BG. DS and IG participated in pilot

study; OA, KE and BG participated in main study. Participants' demographic information and educational backgrounds are presented in Table 3.2 and Table 3.3. Their parents' demographic information is presented in Table 3.4.

DS was a 37 years old female with a diagnosis of mental retardation and epilepsy. Her disability rate was 82%. She has come to present rehabilitation center for three years. At the time of this study, she was not attending any other second institution. Other participant IG was an 8 years old male with diagnosis of autism and pervasive developmental disorders. His disability rate was 40%. He has come to present rehabilitation center for two years. At the time of this study, he was attending to special class in another state school. Both of the individuals were receiving individual special-education services twice a week in the rehabilitation center.

OA was an 11 years old female with a diagnosis of mental retardation. Her disability rate was 50% and her intelligence quotient (IQ) level was 65. She has no additional obstacle. She has come to present rehabilitation center for two years. At the time of this study, she was attending to another Special Education Training Center (full-time). She was receiving individual special-education services twice a week in the Special Bilge Şirin rehabilitation center. Her mother was 44 years old and she did not work. OA's father was 45 years old and he is waiter. Her parent's educational status was primary education. She had three brothers/sisters; their ages were 9, 20 and 25.

KE was a 17 years old female with a diagnosis of mental retardation. Her disability rate was 70% and her intelligence quotient (IQ) level was 40. She has no additional obstacle. She has come to present rehabilitation center for two years. At the time of this study, she was attending to another Special Education Training Center (full-time). She was receiving individual special-education services twice a week in the Special Bilge Şirin rehabilitation center. Her mother was 40 years old and she did not work. KE's father was 45 years old and he is painter. Her mother's educational status was secondary school; her father's educational status was high school. She had one sister; her age was 15.

BG was a 12 years old female with a diagnosis of mental retardation. Her disability rate was 70% and her intelligence quotient (IQ) level was 60. BG has no additional

obstacle. She has come to present rehabilitation center for one year. At the time of this study, she was attending to another special class in secondary school (full-time). She was receiving individual special-education services twice a week in the Special Bilge Şirin rehabilitation center. Her mother was 37 years old and she did not work. BG's father was 40 years old and he is tailor. Her mother's educational status was primary school; her father's educational status was high school. BG had two brothers/sisters; their ages were 10 and 15.

Table 3.2 Demographic Information of Participants

Code	Gender	Chronological Age	Type of Disability	Disability Rate (%)	IQ level	Additional Obstacle
OA	Female	11	a diagnosis of mental retardation	50	65	No
KE	Female	17	a diagnosis of mental retardation	70	40	No
BG	Female	12	a diagnosis of mental retardation	70	60	No
DS (pilot)	Female	37	a diagnosis of mental retardation and epilepsy	82	-	No
IG (pilot)	Male	8	diagnosis of autism and pervasive developmental disorders	40	-	No

Table 3.3 Educational Background of Participants

Code	Attending Time to Rehabilitation Center	Weekly Attendance	Different Institution
OA	2 years	Twice a week / 45 min.	Special Educ. Training Center
KE	2 years	Twice a week / 45 min.	Special Educ. Training Center
BG	1 year	Twice a week / 45 min.	Special class in state school
DS (pilot)	3 years	Twice a week / 45 min.	-
IG (pilot)	2 years	Twice a week / 45 min.	Special class in state school

Table 3.4 Demographic Information of Parents

Code	Age of Mother	Occupation of Mother	Educational Status of Mother	Age of Father	Occupation of Father	Educational Status of Father	Ages of Brothers/Sisters
OA	44	Housewife	Primary Education	45	Waiter	Primary Education	9, 20, 25
KE	40	Housewife	Secondary School	45	Painter	High School	15
BG	37	Housewife	Primary School	40	Tailor	High School	10, 15

3.4.1 Requirements for Participants

To be eligible for participation, individuals must have met the following requirements: (1) ability to follow simple verbal instructions (sentences consist of minimum five words), (2) directing attention to an event for least 10 minutes, (3) ability to imitate motor skills, (4) ability to use hands and fingers, (5) to attend school regularly, (6) ability to point out the answer by using his/her finger or to answer verbally (7) to not do the skill which is planned to be taught, (8) absence of any physical dysfunction or health condition. Researcher discussed with teachers to determine whether subjects meet the requirements.

3.5 Setting and Materials

The study was carried out in the standard classes of special education and rehabilitation center. Classes included shelves, a table and two chairs. Table has the necessary qualifications to run application. The video camera was used in order to keep data records; it was located by teachers to record participants' behavior. To prevent distraction of students due to video camera, video camera was brought to the class before intervention sessions and students were allowed to touch it. Technical properties of tablet and video camera are presented in "Appendix M". During the sessions, participant, researcher and a teacher for video recording were placed in the class (Figure 3.1 and 3.2). Researcher directed the process according to

predetermined instructions (such as drawing attention, making appropriate reinforcement etc.)

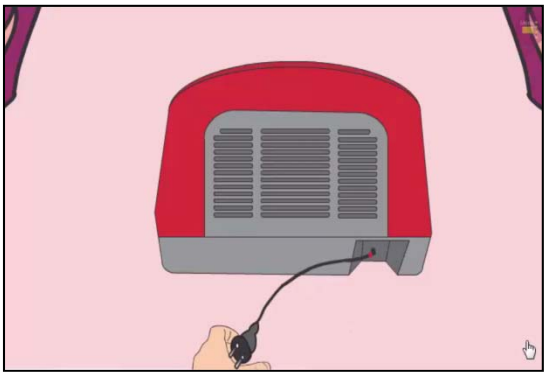
Figure 3.1 Intervention sessions

Figure 3.2 Probe sessions

3.6 Description of the SCV Tablet Application

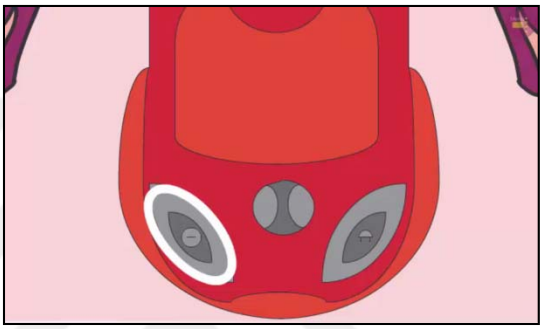
The SCV (sweeping carpet with vacuum cleaner) tablet application to be used in the study was developed in the scope of OZTEK project, which is a TUBITAK supported project. The educational SCV application aims to improve daily living skill of special education individuals such as “sweeping a carpet with a vacuum”. The SCV application's Android and Windows version can be reached from the web address http://www.oztek.metu.edu.tr (OZTEK, 2015). The screen captures of application are presented in Figure 3.3:

1. Introduction of vacuum cleaner

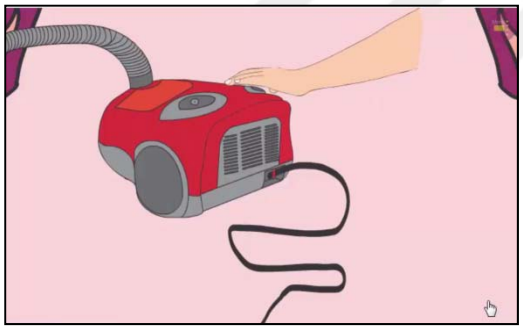


2. Pulling the power cord

3. Plug in the power cord

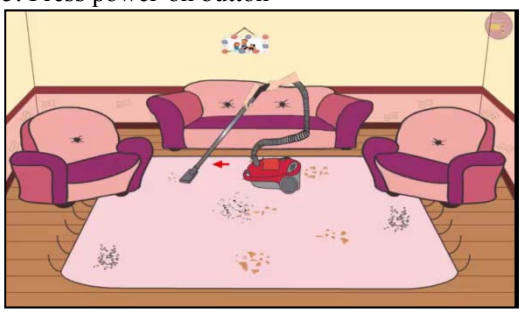


4. Introducing of the power on-off button

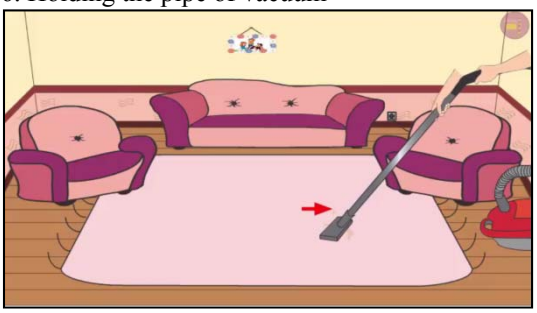


5. Press power-on button

6. Holding the pipe of vacuum

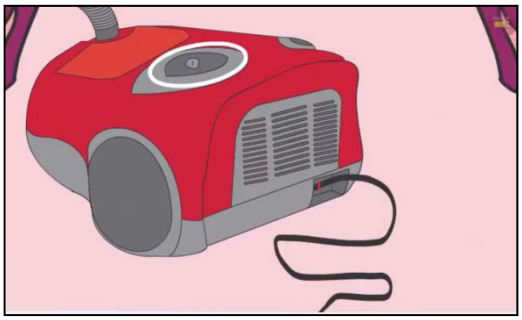


7. Moving the pipe back and forth

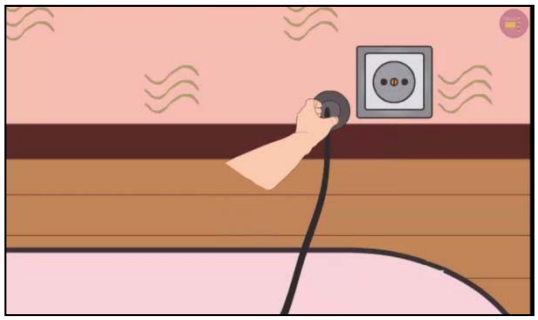


8. Sweeping all over the carpet

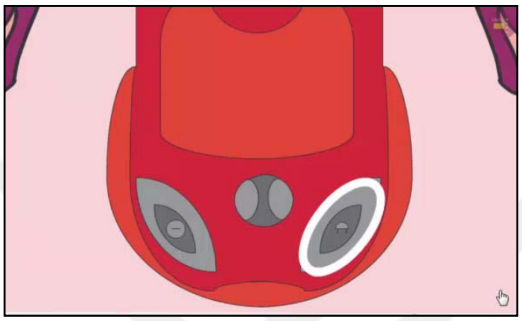
Figure 3.3 Screen captures of tablet application (sweeping carpet with vacuum)



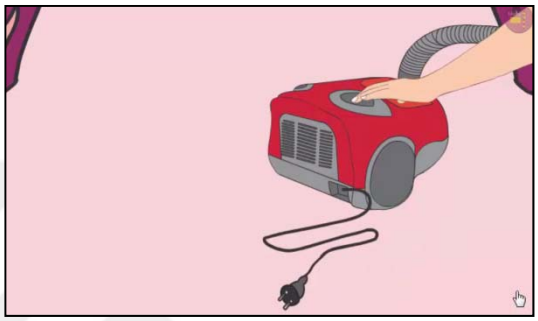
9. Press the power-off button



10. Unplug the power-cord



11. Introducing of rewind button



12. Press the button to rewind cord

13. Move the vacuum on its own place

Figure 3.3 (Continued)

3.7 The Target Stimulus (Main Instruction)

The target stimulus is the "thing" or "situation" to which researcher wants the learner to respond by performing the target skill (Tekin, 2000). The target stimulus reminds learner to perform the behavior while it does not give any clue about how perform it (Tekin & Kırcaali-İftar, 2001). The main purpose of the usage of the target stimulus is to minimize the possibility of learning during the evaluation and reveal the impact of intervention more clearly. In this study, the target stimulus (main instruction) is defined as “to sweep carpet with vacuum cleaner”.

3.8 Experimental Conditions

In the experimental process of the study, the following sessions were conducted: baseline, probe, intervention, generalization and follow-up sessions (see Figure 3.4).

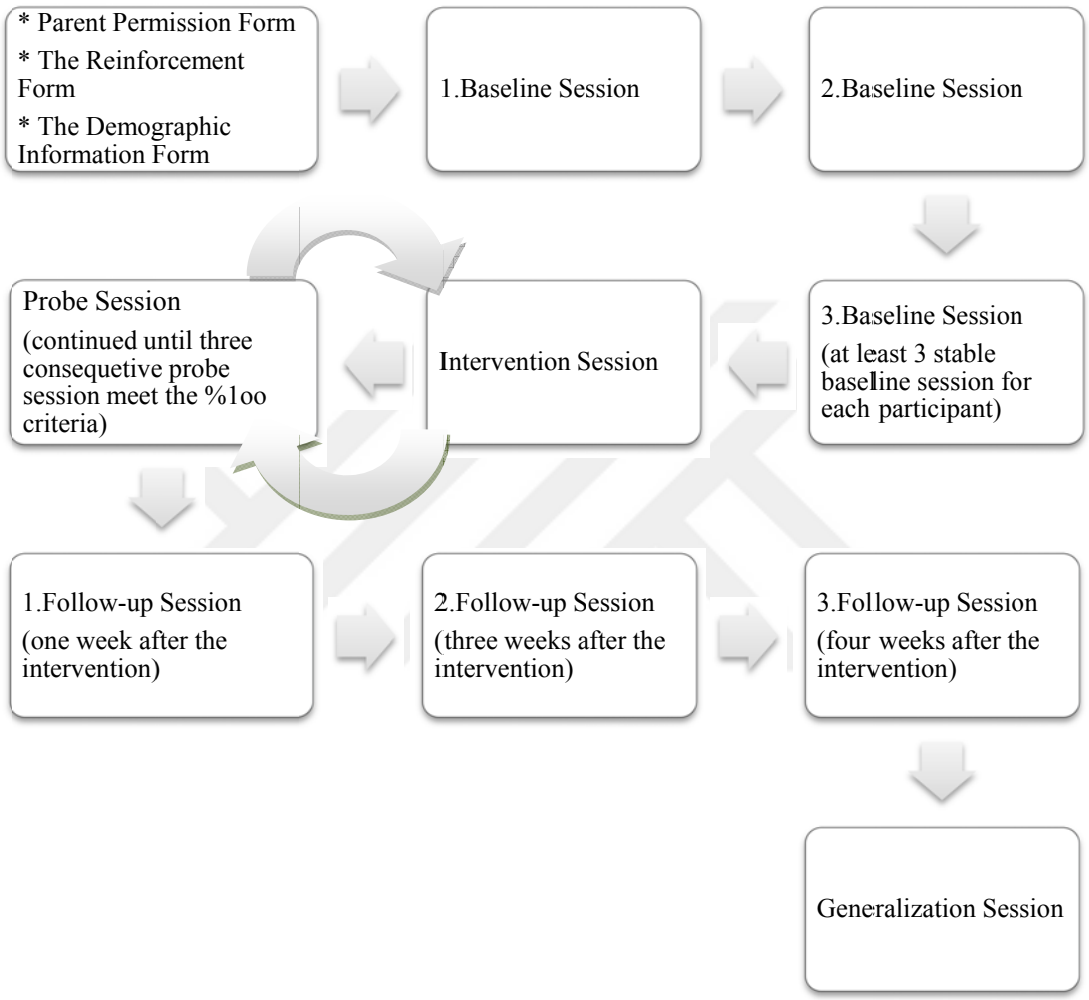


Figure 3.4 The Flowchart of the Implementation Process

Prior to beginning baseline data collection, teachers of individuals collect written parent permission form (Appendix A) for all participants. In addition, for collaboration and participation of individuals continuously is reinforced by giving preferred rewards at the end of sessions. For this reason, teachers fill "the Reinforcement Form" (Appendix C) for students at the beginning of the study.

Baseline at least three probes are collected on each participant to determine his/her level before receiving intervention. In this process, researcher behaves according to pre-arranged instructions (which are given observer to collect procedural fidelity data - Appendix G). Baseline data is collected by giving the main instruction (researcher asks to sweep carpet with vacuum cleaner). Responses of individuals are recorded by video camera. In addition, individuals' correct responses reinforced verbally but wrong answers are not reinforced. The participant who exhibits a stable baseline (at least three sessions) and the greatest need for instruction is introduced to the intervention first (see Figure 3.5).

Probe sessions are organized before each intervention session. Probe data is collected by giving the main instruction (researcher ask to sweep carpet with vacuum cleaner) such as baseline session. After the correct answers of the subject, verbal reinforcement such as "Bravo, well done" is given. Individuals' wrong responses terminate the session (see Figure 3.5).

In *intervention sessions*, daily life skill (sweeping carpet with vacuum cleaner) is taught to individuals with ID by using educational tablet application. The intervention session is continued for each subject until the three consecutive daily probe sessions meet the 100% criteria. The researcher shows each step of tablet application to participant for watching. Then researcher asks participant to try for each step after watching. The correct responses of individuals are reinforced verbally by researcher, wrong responses are ignored and the application is shown again and individuals are asked to try again. This process is repeated until student done all tasks correctly (see Figure 3.6).

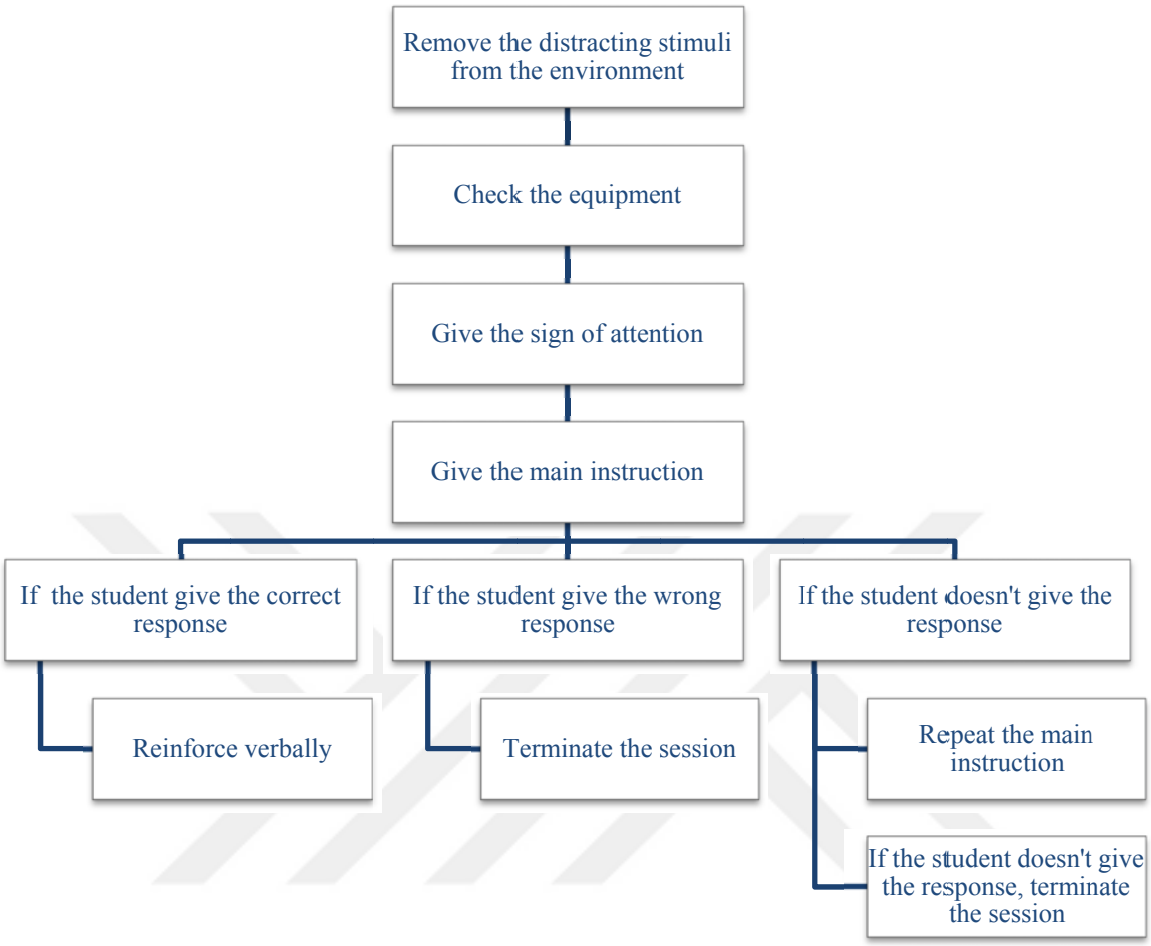


Figure 3.5 The Flowchart of Baseline, Probe, Follow-up and Generalization Sessions

Follow-up sessions are organized like the baseline sessions at one, three and four weeks after the intervention session. Follow-up sessions are executed to examine the maintenance of the newly learned skill. To evaluate if the target skill is generalized to different tools for the target individuals, *generalization sessions* take place. Generalization data is collected a week after all the individuals fulfill the 100% criteria for three consecutive follow-up sessions (see Figure 3.5).

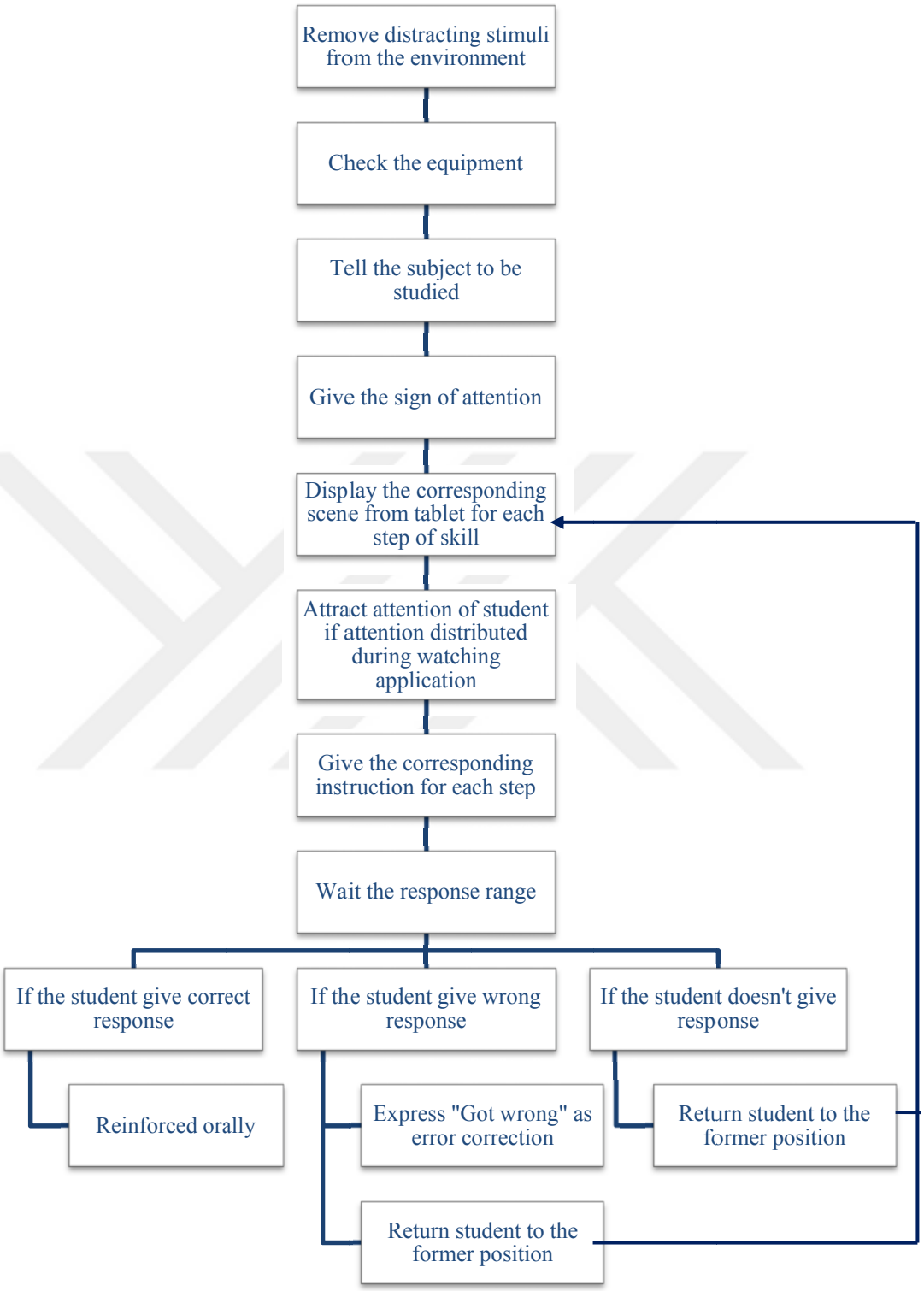


Figure 3.6 The Flowchart of Intervention Sessions

3.9 Data Collection Procedure and Instruments

In this research, five kinds of data are collected: Effectiveness, reliability, social validity, maintenance and generalization, usability (see Table 3.5).

Table 3.5 Data Collection Procedure, Instruments and Roles of Practitioners

Process	Instruments	Data Type	Practitioners
Before the implementation	• The Parent Permission Form	-	Parents
	• The Demographic Information Form	Prior Knowledge	Teachers
	• The Reinforcement Form	Prior Knowledge	Teachers
During the implementation	• Probe, Follow-up and Generalizing Sessions Data Collection Form	Effectiveness Data and Inter-observer Reliability Data	Researcher and Observer
	• Video recording	Usability data	Special education teacher
After the implementation	• Observer Notification Sheet	Inter-observer Reliability data	Observer
	• Probe, Generalization and Follow-up Sessions Procedural Fidelity Checklist	Procedural fidelity data	Observer
	• Intervention Session Procedural Fidelity Checklist	Procedural fidelity data	Observer
	• Satisfaction survey	Social validity data - Usability data	Special education teacher
	• Interview Questions	Social validity data - Usability data	Special education teacher

3.9.1 Collection of Effectiveness Data

In this research during the period of collecting effectiveness data about the target skill, the correct and incorrect reactions of the target individuals are recorded by using "Probe, Follow-up and Generalizing Sessions Data Collection Form" (Appendix D) and the percentage of the correct behavior rate are calculated. In every step of the skill, student behaviors are classified as one of the two types: (a) the student cannot demonstrate the skill; (b) the student can demonstrate the skill at an acceptable rate. The percentages of the behaviors are calculated and the result data are processed graphically by putting "+" on the data collection form when the student

performs the skill at an acceptable rate or putting "-"on the data collection form for other cases.

3.9.2 Collection of the Reliability Data

Inter-observer reliability, procedural fidelity data and inter-coder reliability is collected as the reliability data in this research:

3.9.2.1 Inter-observer reliability and Coder Training

The inter-observer reliability relating to analysis process is followed through comparing the data, which is obtained by the practitioner and the observer for the least 20% of the sessions. The researcher was the primary coder and coded all sessions for all participants. A second coder, a special education teacher with 3-year experience who is graduated from department of psychology, coded 30% of the sessions to assess inter observer agreement.

The researcher and coder were trained on all measures prior to the start of the study. The information relating to intervention and data gathering process is given to coder by using "Observer Notification Sheet" (Appendix F). These steps are followed to collect reliability data: (1) Firstly, all sessions are recorded by video camera; (2) Observer is informed about data gathering process; (3) The sessions, which are collected reliability data are selected randomly; (4) The selected sessions are watched and coded by the researcher and coder. Finally, "consensus / [consensus + dissensus X 100]" formula is used to calculate the inter-observer reliability (Tawney & Gast, 1984).

3.9.2.2 Procedural Fidelity

The purpose of the procedural fidelity is to determine the suitability of actual practice to intended practice. For this reason, practitioner behavior, which is essential for the practice process, is determined and procedural fidelity form is designed. In this study, procedural fidelity data is collected by using "Probe, Generalization and Follow-up Sessions Procedural Fidelity Checklist" (Appendix G) and "Intervention Session Procedural Fidelity Checklist" (Appendix H).

Treatment was carried out by researcher, and procedural fidelity data was coded by the special education teacher who graduated from Psychology department and worked in special education field for three years. 30 % of sessions were selected randomly and coded for fidelity of treatment. Procedural fidelity data is collected from 20% of sessions if the person who studies in special education field carried out treatment, otherwise in the case that the person who does not study in special education field carried out treatment, procedural fidelity data is collected from 30% of sessions (Tekin, 2000). Finally, procedural fidelity is calculated by using "Observed Practitioner Behaviour /Planned Practitioner Behaviour x 100" formula (Billingsley, White, & Munson, 1980).

3.9.2.3 Inter-coder reliability for interviews

Weber (1990) defined content analysis as a systematic, replicable technique for summarizing many words of text into fewer themes based on explicit rules of coding and categorizing. According to Riffe, Lacy and Fico (2005) reliable measurement in content analysis is very important. The key words with respect to reliability are transparency and replication (Gibbert et al. 2008). In this study, in order to assess the reliability of the interview coding two different researchers coded the same body of content.

3.9.3 Collection of the Social Validity Data

The term of "social validity" has its roots in applied behavior analysis, a field that uses Skinnerian principles to study methods for producing changes in observable behavior (Baer, Wolf, & Risley, 1968). Wolf (1978), Kazdin (1977), and Van Houten (1979) leads and define three distinct but related elements of intervention that can be assessed for the social validity: (a) the goals of treatment, (b) the treatment procedures, and (c) the outcomes produced by treatment procedures. Goals can be assessed for both their importance (i.e., what justifies working toward the particular treatment goals?) and their acceptability (i.e., does "society" find the treatment goal to be worthwhile or desirable?). Treatment procedures are usually assessed solely for acceptability, whereas outcomes are assessed for their social

importance (i.e., does the degree of client change represent an important improvement for the client?).

Kazdin (1977) and Wolf (1978) also suggested two approaches for evaluation of social validity. Wolf (1978) mentioned especially the use of subjective evaluation to assess the social acceptability and applied importance of goals, procedures, and outcomes, arguing that subjective evaluations accomplish more objective measurement and that "social importance' [is] a subjective value judgment that only society [is] qualified to make" (pp. 206—207).

Wolf's view that subjective evaluations could provide quantitative data that reflect qualitative judgments about client behavior and capture global judgments of the client's performance or impact on others. Kazdin (1977) also mentioned normative comparisons (see also Kendall, Marrs-Garcia, Nath, & Sheldrick, 1999) as an alternative social validation method for examining the importance of outcomes. With the normative comparison approach, levels of a target problem or deficit are compared with normative data.

In this research, subjective evaluation method is selected for analyzing social validity. Teaching methods and tools used in the study are examined in social aspects. Interviews are done with the special education teachers (Appendix E). Teachers are asked to evaluate the appropriateness of the obtained results. Five special education teachers who joined pilot study or main study as video camera recorder are selected for interview. They asked to assess both pre and post intervention sessions and answer the interview questions to determine their opinions about student learning outcomes.

3.9.4 Threats toward the Internal Validity

Extraneous variables may compete with the independent variable in explaining the outcome of a study. A confounding variable is an extraneous variable that does indeed influence the dependent variable. A confounding variable systematically varies or influences the independent variable and influences the dependent variable. Therefore, experiments that are executed as carefully as they were planned provide

“adequate and proper data” (Campbell & Stanley, 1963). Threats toward internal validity and methods for avoiding threats are explained below:

Single subject research designs address history threats by staggering the introduction of the independent variable across participants in multiple baseline across subjects design (Gast & Ledford, 2010). In this study, when a participant’s behavior is inconsistent with previous performance, it is investigated what might have caused this discrepancy. For example, medicine usage that affects performance of participant is asked to parents. In addition, researcher can ensure that students do not study this skill out of school. Since performance of student is measured before every intervention session, if inconsistent performance occurs, it can be observed during the study.

Another threat is about testing. Repeated testing may have a facilitative effect depending on how the baseline and probe conditions are designed. Facilitative effect is improvement in performance over successive baseline or probe testing (Gast & Ledford, 2010). For avoiding this threat, randomizing stimulus presentation was carried out across sessions, reinforcing all correct responses verbally in several sessions and not reinforcing all steps of skill. Furthermore, reinforcements such as food and toy were given to participants after session completed in randomized manner.

One of the threats toward internal validity is about instrumentations. In single subject research studies, the percentage agreement between two independent observers is the most common strategy for determining whether there is a threat to internal validity due to instrumentation (Gast & Lendford, 2010). Generally, percentage agreement at or above 90% is viewed as acceptable. In this study, inter observer reliability data was collected and percentage agreement was calculated. In addition, specialists in special education field and technology based education field were asked to judge the appropriateness of the items on the instruments. According to specialists’ views, instruments were re-arranged.

Adaptation threat refers to a period at the start of an investigation in which participants’ recorded behavior may differ from their natural behavior due to the

novel conditions (Gast & Ledford, 2010). Participants are exposed to unfamiliar adults (researcher), data collection procedures (video recording) prior to the start of a study. They are allowed to touch video camera.

3.10 Pilot Study

The pilot study was carried out with one male and one female. Both of the individuals have met the participation requirements. Predetermined code names are used to refer to the participants instead of their real names. DS was a 37 years old female with a diagnosis of mental retardation and epilepsy. Her disability rate was 82%. She has come to present rehabilitation center for three years. At the time of this study, she was not attending any other second institution. Other participant IG was 8 years old male with diagnosis of autism and pervasive developmental disorders. His disability rate was 40%. He has come to present rehabilitation center for two years. At the time of this study, he was attending to special class in another state school. Both of the individuals were receiving individual special-education services twice a week in the rehabilitation center.

In the pilot study, “Sweeping carpet with vacuum” skill was studied with individuals. Participants tried to learn how to use vacuum cleaner. At the beginning of the study, parent permission form, the demographic information form and the reinforcement form were filled. According to the reinforcement form, DS’s teacher preferred cake and cookies as reinforcement for her, IG’s teacher preferred toys as a reinforcement for him.

Eight lessons and ten sessions were carried out with each participant (Table 3.6). In the first three sessions, baseline data were collected before the intervention, and after reaching the stable response, which demonstrated that participants did not know the target skill, baseline sessions were ended. Then three intervention sessions and three probe sessions were carried out. After the first intervention session, probe sessions were conducted before each intervention session to measure the learning level of target skill. After reaching the predetermined criteria, which showed that participants learned the target skill, intervention sessions were finished. Finally, generalization

across settings was examined with a new vacuum cleaner. It was conducted as a probe session after the participants had reached the criteria in the target skills.

Table 3.6 Time Schedule of Pilot Study

Lesson No	Session Type	Date
1. Lesson	Baseline Session	01/10/2014
2. Lesson	Baseline Session	15/10/2014
3. Lesson	Baseline Session	17/10/2014
4. Lesson	Intervention Session	22/10/2014
5. Lesson	Probe Session + Intervention Session	24/10/2014
6. Lesson	Probe Session + Intervention Session	05/11/2014
7. Lesson	Probe Session	07/11/2014
8. Lesson	Generalization Session	12/11/2014

3.10.1 Observations during Pilot Study

Difficulties encountered during the pilot study and changes in methodology are presented below:

In the first three sessions of pilot study, sessions were conducted with teachers. Prior to beginning the study, instructions to be followed for the procedural fidelity were explained to the teachers. However, instructions were ignored by teachers during the first three sessions. Then, researcher herself conducted the other sessions of the study according to predetermined instructions. It is important to follow the predetermined instructions (such as drawing attention, making appropriate reinforcements, etc.) during the sessions for the fidelity of treatment.

In the first intervention session, names of vacuum cleaner parts (pipe, floor brush etc.) were demonstrated to participants from tablet, before the sweeping skill. Although individuals could not learn the names of the vacuum cleaner parts, they could match the picture of the part (shown in tablet) and real object. Therefore, they could learn sweeping carpet with vacuum cleaner without learning the names of parts. For this reason, after the first intervention session, only sweeping skill was started to be taught. According to these modifications, after the pilot study tablet application and data collection tools were updated (Changes made in application are mentioned in usability results section).

In the baseline sessions and first probe session of the pilot study, “step by step” principle was applied. Each of the steps required for the sweeping ability was given to the student as a separate instruction. For example, researcher requested student to plug it in, and the student was expected to respond. Next, researcher asked the student to press the open button and response was expected. The instructions were presented one by one for each step. However, this situation was accepted to be a clue that was given to individuals. There could have been an error in measuring whether individuals have learned the skill exactly. For this reason, in probe sessions, it was decided to start with a main instruction. As the main instruction “to sweep the carpet with a vacuum cleaner” was given at the beginning of the probe sessions, responses of the individuals were recorded.

After the pilot study, according to discussions with experts (in special education and educational technology area), it was decided to continue with “step by step” principle for the intervention sessions. In the intervention sessions of pilot study, individuals watched every step from tablet then they were requested to try it himself/herself. For example, “press the power button” step was watched from tablet then he/she was asked to try it. Then, the student watched “pull the plug” step on the tablet and he/she was requested to generalize it on the real vacuum cleaner. An alternative method is starting with main instruction. In this method, at the beginning of the intervention sessions, individuals watch the tablet application from beginning to the end, then the “main instruction” (sweep the carpet with vacuum cleaner) is given and he/she tries to do it. If student cannot successfully complete the instruction, the whole tablet application is shown again until the student achieves the skill without any mistake. In one session, this method (start with main instruction) was also tried, however when student finished to watch application, he/she forgot the first step of the skill. Therefore, this method was not preferred.

The data obtained from the pilot study is presented in the Figure 3.7 and Figure 3.8. At baseline sessions, DS completed 6%, 33% and 22% of the steps correctly in sequential order. After the first intervention session was carried out with the tablet application, DS showed an increase in the percentage of steps completed correctly (over 44%). After the third intervention session, she reached the predetermined

criterion of 100%. In generalization session, DS completed 100% of the steps correctly with a different vacuum cleaner (see Figure 3.7).

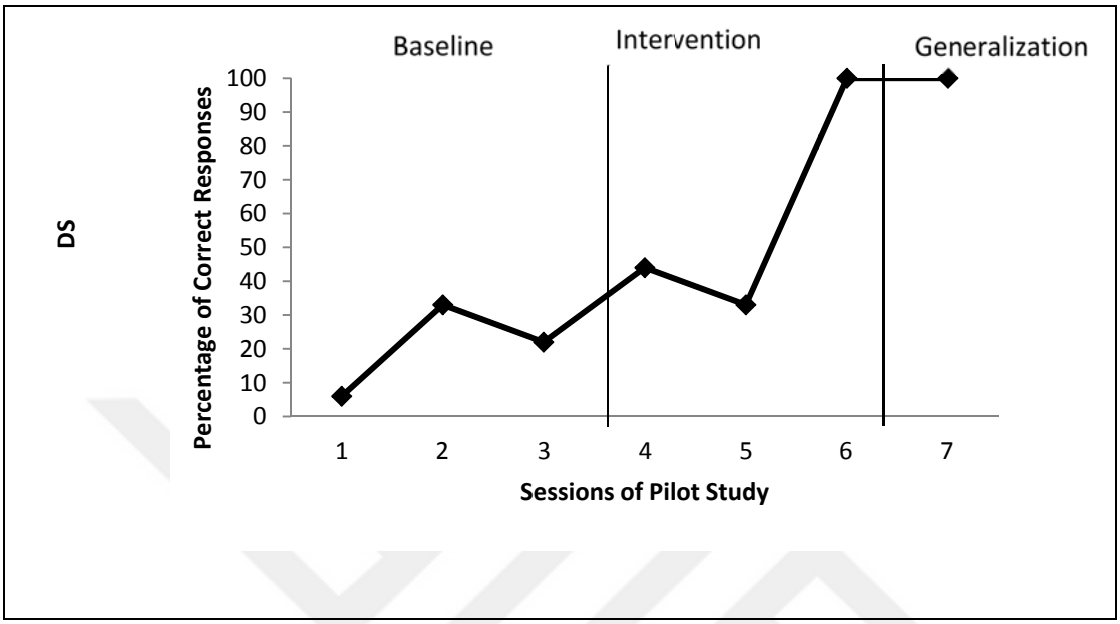


Figure 3.7 Percentage of correct responses for DS during baseline, intervention and generalization probe sessions

At the baseline session, IG showed 28%, 33% and 28% of the steps correctly in respective order. After the first intervention session was carried out with the tablet application, IG showed an increase in the percentage of steps completed correctly (44%). In the last two intervention sessions, he showed an immediate increase in performance (89%) (Figure 3.8). In generalization session, IG performed 100% of the steps correctly with a different vacuum cleaner.

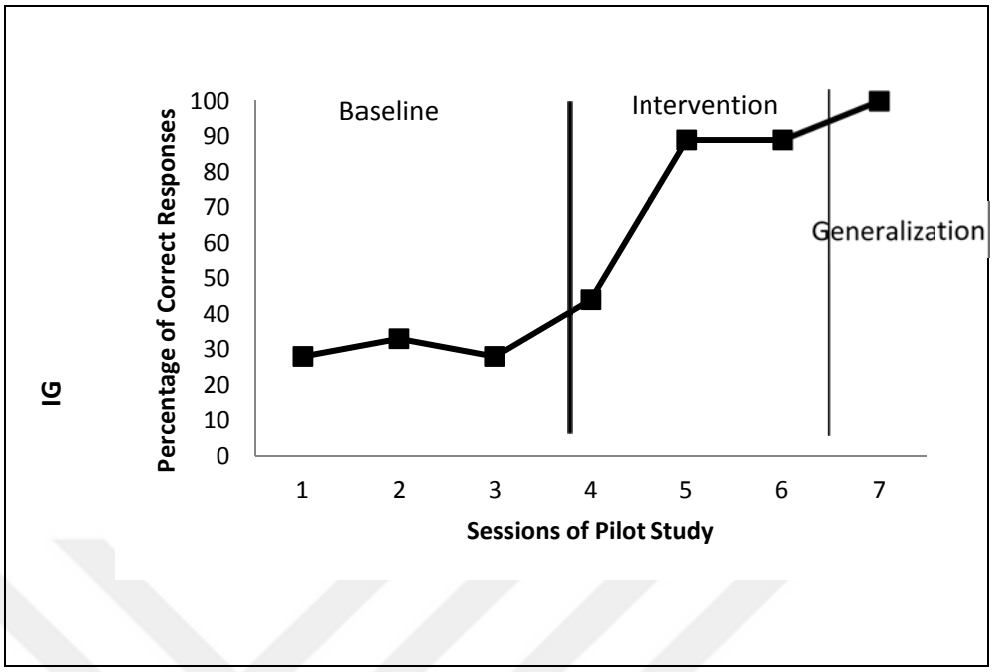


Figure 3.8 Percentage of correct responses for IG during baseline, intervention and generalization probe sessions

3.11 Data Analysis Procedure

The study includes both qualitative and quantitative structured data, which require parallel analysis techniques. Demographic information of the participants are collected and reported in terms of their frequencies and percentages. The data regarded with the effectiveness of tablet application is analyzed by graphical analysis. X axis of the graphic shows the number of sessions, y axis shows the percentage of correct responses. Qualitative data (interviews, video recording) analysis is conducted regarding the content analysis explained by Yıldırım and Şimşek (2000) as "The data is coded, themes are found, the data is organized and defined according to the codes and themes, and interpretations are made".

CHAPTER 4

RESULTS

4.1 Introduction

The results of this study that aims to investigate the effectiveness of educational interactive tablet applications to teach a daily living skill to individuals with intellectual disabilities are presented in this chapter. Results are explained according to research questions. The main titles of findings are presented as following: (1) effectiveness (2) maintenance and generalization (3) reliability (4) social validity and (5) usability (shown in Table 4.1).

Table 4.1 Main Titles of Findings related with Research Questions

Research Questions	**Data Type**
Research Question 1: Does the educational tablet application contribute to learn daily living skills for individuals with ID?	Effectiveness and Reliability
Sub-question 1.1: How is the persistence of the newly learned skill at one, three and four weeks after training finished?	Maintenance and Reliability
Sub-question 1.2: How is the generalization of the newly learned skill in different tools?	Generalization and Reliability
Research Question 2: What are the usability issues of the educational tablet application for individuals with ID in terms of effectiveness, efficiency and satisfaction?	Usability
Research Question 3: What are the views of special education teachers about the utilization of the educational tablet application? What is the graded rate of special education teachers' satisfaction about the educational tablet application?	Social Validity

4.2 Effectiveness Data

The effectiveness data obtained in the study related with teaching to sweep carpet with vacuum by using educational interactive tablet application is shown in Figure 4.1. The horizontal axis of the graphic shows the number of all probe sessions (baseline, during intervention, follow-up and generalization); the vertical axis shows the participants' percentage of correct responses during all probe sessions. The results are examined in four stages for each participant: (1) baseline sessions, (2) probe sessions after each intervention session, (3) follow-up sessions and (4) generalization sessions.

4.2.1 Effectiveness Data of First Participant OA

The first participant OA's percentage of correct responses during baseline, intervention, follow-up and generalization sessions are shown in Figure 4.1. Three baseline sessions were performed before teaching a skill of sweeping carpet with vacuum by educational tablet applications. According to baseline data, the mean score of OA in sweeping carpet with vacuum is 10%. It means that she performed averagely 10% correct responses during baseline sessions. She performed only one same step (hold the pipe, move back and forth) right in all sessions; she could not perform other steps of the skill.

After the first intervention session, participant OA performed 10% correct response in the first probe session as shown in Figure 4.1. In the second probe session which done after the second intervention session, there is a big increase in the correct response rate and she performed 90% correct response in the second probe session. After the third intervention session, OA improved the percentage of correct steps to 100% in the third probe session and at last following two probe sessions. Thus, she performed the ability to sweep carpet with a vacuum correctly during all steps. The desire extent (100%) was reached at least three consecutive sessions, so intervention sessions were terminated.

4.2.2 Effectiveness Data of Second Participant KE

The second participant KE's percentage of correct responses during baseline, intervention, follow-up and generalization sessions are shown in Figure 4.1. Four baseline sessions were performed before intervention sessions. According to baseline data, the mean score of KE in sweeping carpet with vacuum is 10%. It means that she demonstrated averagely 10% correct responses during baseline sessions. She performed only one same step (hold the pipe, move back and forth) right in all sessions; she could not perform other steps of the skill.

After the first intervention session, participant KE performed 10% correct responses in the first probe session as shown in Figure 4.1. In the second probe session that was done after the second intervention session, KE performed 10% correct response. After the third intervention session, there is a big increase in the correct response rate and she performed 100% correct responses in the third probe session and at last two probe sessions. Thus, she performed the ability to sweep carpet with a vacuum for all steps correctly. The desire extent (100%) was reached at least three consecutive sessions, so intervention sessions were terminated.

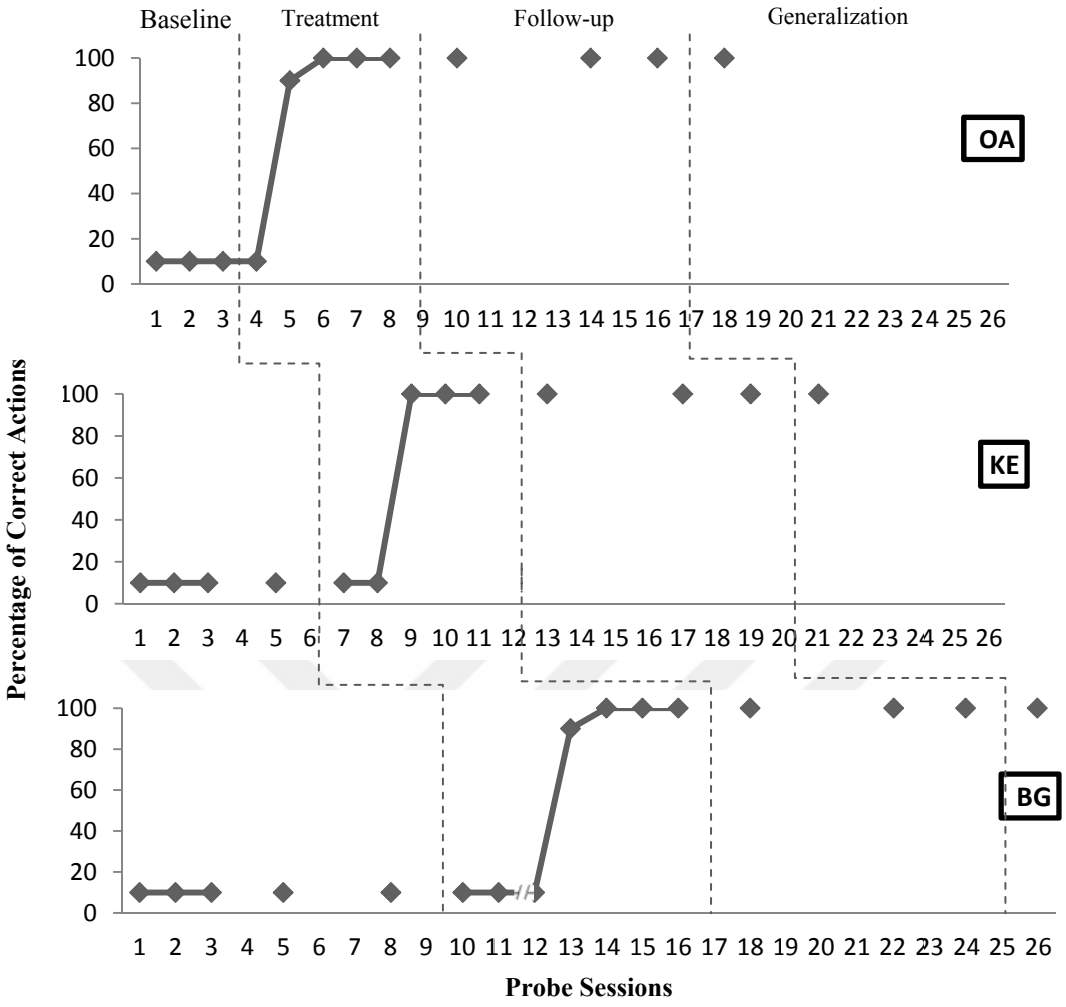


Figure 4.1 Three Participants' Percentage of Correct Actions for the Baseline, Treatment, Follow-up and Generalization Sessions

4.2.3 Effectiveness Data of Third Participant BG

The third participant BG's percentage of correct responses during baseline, intervention, follow-up and generalization sessions are shown in Figure 4.1. Five baseline sessions were performed before teaching a skill of sweeping carpet with vacuum by educational tablet applications. According to baseline data, the mean score of BG in sweeping carpet with vacuum is 10%. It means that she demonstrated averagely 10% correct responses during baseline sessions. She performed only one same step (hold the pipe, move back and forth) right in all sessions; she could not perform other steps of the skill.

After the first and second intervention session, participant BG performed 10% correct responses in the first and second probe session. After the second intervention session, she did not come to rehabilitation center for one session as shown in Figure 4.1. In the third probe session, she performed 10% correct responses. After the fourth intervention session, there is a big increase in the correct response rate of participant BG. She improved the percentage of correct steps to 90% in the fourth probe session. Finally, after the fifth intervention session, she performed the ability to sweep carpet with a vacuum for all steps (100%) correctly in the fifth probe session and at last two probe sessions. The desire extent (100%) was reached for at least three consecutive sessions, so intervention sessions were terminated.

4.3 Maintenance and Generalization Data

Research problem related to maintenance examines if educational tablet application contribute to sustain daily living skill (sweeping carpet with vacuum) for individuals with ID after the one, three and four weeks from the last intervention probe. The data about the persistence of the newly learned skill is showed in Figure 4.1.

Three participants (OA, KE, BG) complete all tasks (100%) correctly in three follow-up sessions. The skill of sweeping carpet with vacuum consists of ten steps; participants complete all steps of the skill without any help and it shows that participants sustain the newly learned skill after the intervention process. For this reason, it can be said that instruction with educational tablet applications to individuals with ID is successful in terms of maintenance.

In terms of generalization, three participants (OA, KE, BG) performed the sweeping ability 100% accuracy levels by using different tools (vacuum cleaner and carpet) as seen in Figure 4.1. Therefore, it can be said that participants are able to generalize the newly learned sweeping skill to different tools.

4.4 Reliability Data

In this part, inter-observer reliability data, procedural fidelity data and inter-coder reliability data are presented:

4.4.1 Inter-observer Reliability Data

In order to assess the reliability of the coding, at least two different researchers must code the same body of content. Inter-observer reliability refers to the extent to which two or more independent observers agree on the coding of the content of interest with an application of the same coding scheme. Observers are researcher itself and 3 year experienced special education teacher graduated from department of psychology. 30% of all different type sessions are randomly selected and inter-observer reliability data is collected from these sessions. In this part, "consensus / [consensus + dissensus X 100]" formula is used to calculate the inter-observer reliability. The inter-observer reliability data in single-subject research is expected to be at least 80% (Tawney & Gast, 1984). The consensus between two observers was at 100% for all participants and all session types as shown in Table 4.2.

Table 4.2 Inter-observer reliability data for each participant and session

	Baseline Sessions %	Probe Sessions (during Intervention)%	Follow-up Sessions %	Generalization Sessions %
Participant OA	100 (1)*	100 (2)	100 (1)	100 (1)
Participant KE	100 (1)	100 (2)	100 (1)	100 (1)
Participant BG	100 (2)	100 (2)	100 (1)	100 (1)

*the number of sessions calculated as 30% of total session number

4.4.2 Procedural Fidelity Data

The purpose of the procedural fidelity is to determine the suitability of actual practice to intended practice. Procedural fidelity data is calculated for each different type of sessions (probe sessions, intervention sessions, follow-up and generalization sessions). Approximately %30 of all session types are selected randomly and coded according to "Procedural Fidelity Checklist " (Appendix G and Appendix H). Procedural fidelity is calculated by using "Observed Practitioner Behaviour / Planned Practitioner Behaviour x 100" formula (Billingsley, White, & Munson, 1980).

Procedural fidelity Data for Probe Sessions: 3 sessions with first participant (OA), 4 sessions with second participant (KE) and 5 sessions with third participant (BG), in total 12 baseline sessions' data was collected. The number of probe sessions done

during intervention process are respectively as follows: 5 sessions with first participant (OA), 5 sessions with second participant (KE) and 7 sessions with third participant (BG) in total 17 intervention probe sessions. Totally 29 probe sessions data were collected and 9 sessions (calculated as 30% of total probe sessions) are selected randomly and procedural fidelity analyze is done. Procedural fidelity data shows that practitioner performed the probe sessions with 100% accuracy level.

Procedural fidelity Data for Intervention Sessions: 3 sessions with first participant (OA), 3 sessions with second participant (KE) and 5 sessions with third participant (BG), in total 11 intervention sessions' data was collected. 4 sessions (calculated as 30% of total intervention sessions) are selected randomly and procedural fidelity analyze is done. Procedural fidelity data shows that practitioner performed the intervention sessions with 98% accuracy level.

Procedural fidelity Data for Follow-up Sessions: 3 sessions with first participant (OA), 3 sessions with second participant (KE) and 3 sessions with third participant (BG), in total 9 follow-up sessions' data was collected. 3 sessions (calculated as 30% of total intervention sessions) are selected randomly and procedural fidelity analyze is done. Procedural fidelity data shows that practitioner performed the follow-up sessions with 100% accuracy level.

Procedural fidelity Data for Generalization Sessions: 1 generalization session was realized with each of all three participant (OA, KE, BG), in total 3 generalization sessions' data was collected. 1 session (calculated as 30% of total generalization sessions) are selected randomly and procedural fidelity analyze is done. Procedural fidelity data shows that practitioner performed the generalization sessions with 100% accuracy level.

Table 4.3 Procedural fidelity data for all sessions

	Probe Sessions	**Intervention Sessions**	**Follow-up Sessions**	**Generalization Sessions**
Total session number	29	11	9	3
Evaluated session number (calculated as %30 of total sessions)	9	4	3	1
Procedural fidelity Data (%)	100	98	100	100

Finally, procedural fidelity results show that actual practice is suitable to intended practice for all sessions as shown in Table 4.3. Intervention, probe, follow-up and generalization sessions' process steps are applied as previously defined.

4.4.3 Inter-coder Reliability Data

In order to assess the reliability of the interview coding two different researchers coded the interview transcript. Researchers are experienced in coding and they are working as research assistant in university. Firstly, they limited the inter-coder reliability test to a sample of the body of content; they coded only one question of interview together. They determined the rules and they decided that each question can be main-theme and important statements of teachers for each question can form sub-themes.

According to these predetermined rules, two researchers coded all interview transcripts. Then themes and subthemes were compared and reliability coefficients were calculated. Reliability coefficients can be used to assess how much the data deviates from perfect reliability. In the literature review, there is no consensus on a single 'best' coefficient to test the inter-coder reliability (Lombard et al., 2004). Percent agreement was used in this study. The agreements between coders were 100% for themes, 91% for sub-themes.

4.5 Social Validity Data

Educational SCV tablet application used in the intervention sessions for individuals with ID is examined in this part. Teachers' satisfaction level about SCV tablet application and their views about SCV application and educational usage of tablets are collected. Survey findings and interview data are presented in table 4.4, 4.5 and 4.6 as social validity data. Teachers' satisfaction level about the SCV application has the highest average points (4.77) (see Table 4.4). All teachers think that students have a good time with the SCV application and all of teachers want similar products to be developed. They give highest points (5.0) to these statements. On the other hand, effectiveness theme get the lowest score (4.12). Teachers give the lowest point (3.2) to "Knowledge level of SCV application is very easy for my students." In

interviews, teachers state that difficulty level of application is suitable for students with ID.

Table 4.4 Mean of Teachers' Satisfactions about the SCV application

Themes	Items	Mean	Mode	Overall Mean
Controllability	SCV application can be used easily in the classroom and at home.	4,8	5	4,47
	Information organization of SCV application is not confusing.	4,6	5	
	SCV application can be controlled easily.	4	5, 4	
Learnability	Understanding to SCV application does not take so much time of my students.	3,8	5	4,20
	Learning to use of SCV application is easy.	4,4	4	
	Steps of SCV application can be understood easily by students.	4,4	4	
Effectiveness	SCV application is useful for my students.	4,8	5	4,12
	Knowledge level of SCV application is not very difficult for my students.	4,4	4	
	Knowledge level of SCV application is very easy for my students.	3,2	2	
	My students develop the prior knowledge with the SCV application.	4,2	5, 4	
	My students develop the tablet skills with the SCV application.	4	4	
Satisfaction	My students like the SCV application.	4,8	5	4,77
	SCV application attracts my students' attention.	4,8	5	
	My students want to use SCV application again.	4,6	5	
	SCV application is not boring, so my students complete the application.	4,8	5	
	My students have a good time with SCV application.	5	5	
	I want similar products to SCV application to be developed.	5	5	
	I suggest the SCV application to teachers and parents.	4,4	5	
Design	Visual design of the SCV application is suitable for students.	4,4	4	4,4
	Sound quality of the SCV application is suitable for students.	4,4	4	

Table 4.5 Teachers' views about educational usage of tablets

Theme	Sub-theme	Teachers' statements
Experience	*My experiences about usage of tablets for educational purposes are...*	
	• Mobile phone (with touch screen) instead of tablet	"Sometimes, we use mobile-phones with touch screen instead of tablets. We use basic addition and subtraction games or literacy applications." "I use my mobile-phone for activities such as educational games or painting." "For example, we download illustrations of fruits on our phones and try to make slide from them. It takes lots of time; applications such as SCV are useful for us." "I use mobile-phone instead of tablet for teaching colors, numbers."
	• Computer instead of tablet	"We use computers instead of tablets for teaching colors, numbers and painting."
	• No experience	"I have never used tablets before."
Attitude	*I want / do not want to use tablets in my lessons, because...*	
	• Draw attention, keep attention for long time	"I would like to use tablets in my lessons, because they can increase the children's attention and keep the attention for longer time. Despite the fact that it could be hard to keep some students with special educational needs in the classroom for ten minutes, they can study much longer time with devices such as tablets." "Large -screen tablets can be attractive for our students. If tablet size is close to the TV screen size, it can be better for students, they can see more comfortable."
	• Already use mobile phone	"I would like to use tablet, but I'm already using my mobile-phone."
	• Wish that tablets exist in all classes	"I think that many things will be done with tablet in the future. However, if tablets exist in all classes and we have an opportunity to study with them in our lesson, it can be better."
Training about Educational Tablet Usage	*I want/ do not want to take training about educational usage of tablets, because...*	
	• To be useful for students	"If we take tablet training about how we can be more beneficial to our students, of course it can be better." "It provide effective learning environment for individuals with special needs."
	• Learning activities are varied	"I would like to take tablet training, because I could vary my learning activities for students."

Table 4.5 (Continued)

	• Have not opportunity to practice with students	"I took a course about material design in college, I took training about tablets, but I had no opportunity to practice tablet with students. So, training about tablets would be good for me."
	• Insufficient number of tablet application	"Our institution doesn't provide any training about tablets, since there is no sufficient number of tablet applications for special education. If application number is enough, we want to take training."
	• Facilitate teachers' work load	"It facilitate teachers' work load."
Perceived Easiness	*Tablet usage in lessons can be easy/ difficult, because....*	
	• Because of individual differences, it is easy for some students, difficult for some	"Unfortunately, difficulty and ease terms would change according to every student in special education field. Each student has individual differences. For example, it is easy to use tablet for schoolchildren such as OA. They can learn many things about tablets very easily. I think that tablets are beneficial for them." "It can be changed according to student, but almost all students like to use it."
	• Can be adapted after a few easy exercises	"It isn't difficult and complex. When they first meet with this device, they behave shyly. But after a short adaptation process, they can be able to use tablet easily."
	• Computers are more complicated than tablets.	"We can use telephone and tablet by putting them on table; I think they are very usable, and easy to use. When we compare tablets with computers, it can be said that using tablet is easier than using computer. Because of touch screen, tablets are easier. While using computers, students have to press buttons and move mouse. This is more complex for students with special needs." "Formerly, we studied with computers, but it is more difficult to study with computers than tablets."
	• Providing focus	"Tablets don't force the student to learn a new skill or communicate, already tablets draw their attention." "Especially touch screen property of tablets attracts attention of children with special needs."

Table 4.5 (Continued)

	My institution does not provide tablets to use in lessons, as an alternative/ because...	
Institutional Support	• Personal mobile phone with touch screen	"We have not tablets, but we use our own mobile-phones to teach new skills, concepts such as sounds of animals or colors." "Sometimes, we use our mobile-phones in lessons. I use it for drawing attention or giving reinforcement."
	• Insufficient number of tablet applications	"Now, there is no institutional support because the number of available applications for special education field is not enough. Even if tablets are provided for teachers, we can't find available application for executing on tablets."

Teachers' views about tablet usage in education were categorized under five themes as following: (1) Experience (2) Attitude (3) Training about tablet usage (4) Perceived easiness (5) Institutional support (Table 4.5).

(1) Teachers have no experiences about usage of tablets for educational purposes. They expressed that they generally used their personal mobile phones (with touch screen) instead of tablets. One teacher stated that he/she used computers for teaching colors and numbers. They generally used mobile phones and computers to teach concepts (mathematical, literacy, fruits, colors etc.).

(2) Teachers' attitudes about tablet usage for educational purposes are very positive. They stated that they might use tablets to increase attention of students and keep attention for longer time. They wish that tablets exist in all classes in future.

(3) Special education teachers want to take training about educational tablet usage, because they want to vary their learning activities. One teacher took training about tablets in graduate education but they had no opportunity to practice with them. In addition, teachers expressed that there are no sufficient number of tablet applications for special education students.

(4) Teachers expressed that perceived easiness term can change according to every student, since each student has individual differences. Tablet usage is not difficult and complex, after a short adaptation process, they can get used to tablet easily. Teachers compared computers and tablets in terms of easiness, they stated that computers are more complicated than tablets, because while using computers, students have to press buttons and move mouse. It is more complex for students with

special needs. Tablet usage in lessons can be easy, because it provides focus. Tablets do not force the students to learn a new skill; already students' attention is attracted.

(5) Special education rehabilitation center in which study carried out does not provide tablets to use in lessons. One of teachers who work also in management team expressed that there is no institutional support because the number of available applications for special education field is not enough. For this reason, teachers alternatively used their own mobile phones with touch screen instead of tablets for drawing attention or giving reinforcement.

Table 4.6 Teachers' views about the SCV tablet application

Theme	**Sub-theme**	**Teachers' statements**
Effectiveness	*SCV tablet application is/isn't effective / instructive, because....*	
	• Visual / audio content is presented together	"SCV application is instructive for our students because visual content of application is suitable for their level of knowledge. I think it is successful at teaching new skill." "This application provides audio and visual stimuli such as cartoons, so it draws attention of children." "Visual information presented from tablet is more effective than orally presented information." "I think it is effective because of visual content."
	• Practice based (real materials used)	"I think learning new information by making practice is more functional and rational, this method (by doing oneself) is effective for our students." "It is very effective to make practice with real materials in the learning process"
	• Training of daily living skill	"It is an effective and useful tool for teaching daily living skills to our students."
	• Ideal for female students	"Especially, it is effective for female students."
Usefulness	*SCV tablet application is /isn't useful, because....*	
	• Increases the technologic skills	"Students also gain new technologic skills by using tablets."
	• Increases the time of focus	"I think it develops the skill of focus." "Technological devices such as tablets, phones are already draw the attention of student. Using these devices in lessons increases the focus time."
	• Develops motor skills	"I think that it is useful for developing motor skills because it offers an opportunity to make practice with real materials. Practice based learning is useful for students, they don't forget easily."

Table 4.6 (Continued)

	• Supports self-confidence	"Student can do this task independently, after learning process. To be able to do task own self increases their self-confidence." "Their parents don't give opportunity for them to sweep carpet or similar tasks at home, because they don't trust them and they don't think their child's capacity sufficient for this task. So when students can do this task like their family members, they think that themselves are sufficient individuals, their self-confidence increase. "
	• Saves time of teacher	"For some students, it is useful to save time of teachers."
	• Parents willing to daily living skill training	"Parents would like to take a training of daily living skill for their child." "Parents are willing to that their children gain this type of skills."
	• Helps to transfer/ generalize	"The most important problem of our students is trasfer and generalization. They learn something but they can not generalize to other belongings. Tablets provide the opportunity to demonstrate the different varieties of the same material to students.
	SCV tablet application is /is not enjoyable, because...	
	• Different method	"Students enjoyed very much. Especially OA was very happy, she asked you to me when you were away. This method is different from the method they used to. They studied with tablet accompanied by teachers that is very interesting for them."
	• Increased concentration / sense of wonder	"Application increased their concentration." "It attracted students' attention by reason of being an unusual lesson." "It increased the sense of wonder."
Enjoyment	• Students are happy to do task independently	"Students like application very much; to be able to do something independently increases their self-confidence. We observed happiness and excitement in the eyes of children." "Children were pleasant to do task independently. They think that there were no difference between themselves and their mother/sister, they can do similar tasks which always their mother/sister done.

Table 4.6 (continued)

	SCV tablet application is easy/difficult, because...	
Easiness	• Learning the use of application is easy	"According to me, it is easy to learn. Especially, OA start to use tablet alone, she can stop and replay the application." "It is easy to use tablet and application, even student can stop/replay application itself." "It doesn't take too much time to learning the use of application."
	• Suitable for children who have prerequisites behaviors	"Difficulty level is suitable for children who have prerequisites behaviors."
	• Easy method / easy after a few practice	"It is easy for students to watch application visually and both to apply with real materials. After the first practice, they adapted the course."
	• It was difficult to gather not to be swept belongings placed on carpet (in pilot study)	"In pilot study, it was difficult to understand that they have to gather not to swept belongings placed on the carpet, because there weren't exactly the same belonging with application. According to me, it is an insignificant detail, learning the whole sweeping process is more important."
	I would /would not like to use SCV application in the future, because....	
Attitude (Future use)	• Enjoyable, Useful, Interesting	"I want to use this type of applications. These are enjoyable and interesting, although these are useful for our students."
	• Fast data transfer	"Some skills are gained more quickly with tablet than other methods. Tablet application can be used to ensure familiarity about skill to student. However, I can show the whole of skill with the tablet application quickly."
	• Visual and audio support	"I can use this type of applications for support their visual memory." "I want to use SCV application, because visual and audio supports together facilitate their learning process."
	• Save time of teacher	"Visual presentation of information with tablet is better than only verbally presented information. Tablet could help to save time of teacher."

Table 4.6 (Continued)

	SCV tablet application's some properties need to be changed are...	
Properties need to be changed	• Teaching the parts of vacuum one by one (in pilot study)	"Teaching the names of vacuum parts one by one was not suitable for DS (participant in pilot study); I said that during pilot study. Since, learning names of parts is more difficult than learning whole skill. Motor skills are more easily learned than cognitive skills. You already remove that part from the application in the main study."
	• Gathering not to be swept belongings placed on carpet (in pilot study)	"According to me, gathering not to be swept belongings placed on carpet screen must be removed from the application. Because sweeping operation should be taught with the most basic principles at first.
	• No need to change	"May be, it is a good application, there is no parts need to be changed." "I like the application; I can't see any part need to be changed. Also, parents like the application and students found a different learning environment."
	• Only hand is seen during sweeping (could be seen the body of the character)	"During the sweeping operation it seems just hands, body of character doesn't appear. May be, body of character seem completely would be better."

Teachers' views about SCV tablet application were categorized under six theme as following: (1) Effectiveness (2) Usefullness (3) Enjoyment (4) Easiness (5) Attitude (future use) (6) Properties need to be changed (Table 4.6).

(1) In terms of effectiveness, most of special education teachers stated that SCV tablet application is effective since visual and audio content is presented together in application such as cartoons. Therefore, it draws student's attention. However, they added that it is very effective to make practice with real materials. Using SCV application is an effective method to teach a daily living skill especially for females.

(2) Special education teachers expressed that SCV tablet application is useful, because students gain new technological skills and tablets increases students' limited focusing time. Some teachers stated that SCV application helps to develop motor

skills of students. In addition, to be able to do task independently increases their self-confidence. Their parents do not give opportunity for them to sweep carpet or similar tasks at home, So when students can do this task independently like their family members, they think that themselves are sufficient individuals, their self-confidence increase. Another useful aspect of SCV application is that it saves time for teachers.

(3) Special education teachers stated that SCV tablet application is enjoyable, since this is a different method and interesting for them. It increases the sense of wonder for students with special needs. In addition, students are happy to do task independently.

(4) Special education teachers stated that SCV tablet application is easy, because difficulty level of application is suitable for children who have prerequisite behaviors. In addition, they expressed that learning the use of application is easy. One teacher who participated pilot study said that it was difficult to gather not swept belongings placed on carpet. This step of the skill was removed after pilot study.

(5) In terms of attitude, all teachers in the study told that they would like to use SCV application in the future. Teachers found this application enjoyable, interesting and useful for their students. They explained that some skills are gained more quickly with tablet compared to traditional methods, moreover visual and audio support together facilitate special students' learning process. In addition, it helps to save limited time of teachers.

(6) Special education teachers expressed some properties need to be changed. Firstly, teachers said that teaching the names of vacuum parts one by one was not suitable for students (in the pilot study). In addition, another teacher said that gathering not to be swept belongings placed on carpet screen must be removed from the application (in pilot study). These two properties were changed after pilot study. Some of teachers said that there is no parts need to be changed in application.

4.6 Usability Data

SCV application developed within the scope of OZTEK project is examined in terms of usability. Effectiveness, efficiency and satisfaction terms of usability are analyzed

for this purpose. In this section, pilot version of SCV application and new version of SCV application developed after pilot study are compared and analyzed broadly.

After the pilot study, according to the observations and suggestions of special education teachers, some changes were made in SCV tablet application. In the old version of the application, there were two main sections: "Parts of vacuum cleaner" and "Sweeping carpet". The main change is that "parts of vacuum cleaner" section, which told the names of parts, is removed. In addition, another important change is done in the "Sweeping carpet" section. These changes are told broadly in Table 4.7.

Table 4.7 Changes in SCV Application Used in The Pilot Study

Screen No	Changes
1. Screen:	It starts with the sound "Let's start to sweep carpet with vacuum cleaner". "We have learned materials" part of sound was removed. Bear, pencil and money pictures, which placed on the carpet as background picture, were removed.
2. Screen:	There was no change in the screen of pulling the plug from the socket.
3. Screen	There was no change in the screen of plug in. Only, changes were made in the sound because the sound was repeated.
4. Screen	The screen of checking belongings not to be swept placed on the carpet was removed completely.
5. Screen	The screen of gathering belongings not to be swept was removed completely.
6. Screen	The screen, which shows to press the power on button, was changed. It was zoomed to power on button and the sound "there is a round sign on the power on button" was added. The power-on button was introduced in this section.
7. Screen	There was no change in the screen, which showed to hold the pipe of vacuum cleaner.
8. Screen	The screen of starting to sweep from the edge of carpet was removed completely.
9. Screen	There was no change in the screen of moving the pipe of vacuum back and forth.
10. Screen	The screen, which shows that dusty places should be swept more carefully, was removed completely.
11. Screen	The screen which shows that it should be ensured that floor brush touch the carpet was removed completely.
12. Screen	There was no change in the screen, which shows that all carpets can be swept in this way.
13. Screen	The screen, which shows that it should be ensured that no dusty place remains, was removed completely.
14. Screen	The screen, which shows that the remaining dusty places should be swept again, was removed completely.
15. Screen	The screen, which showed to press the power off button, was changed. It was zoomed to power off button and the sound "there is a round sign on the power off button" was added. The power-off button was introduced in this section.
16. Screen	In the unplugging from the socket screen, the part of sound which "I did, you try it" was cropped.

Table 4.7 (Continued)

17. Screen	In the screen of introducing the power cord plug, the function button, which used for wrapping cord, was zoomed and the sound "Plug symbol is placed on button" was added.
18. Screen	There was no change in the screen, which shows that sweeping is finished, let us put the vacuum cleaner to its own place.

In terms of effectiveness, participants' achievement level according to skill steps of pilot version and new version of SCV application and general success rate for two version of application are analyzed. The data about effectiveness of educational tablet application is presented in Table 4.8, Table 4.9, Table 4.10 and Table 4.11.

Table 4.8 Participants' success level according to steps of skill in Pilot Study (Before Changes in Application) - Effectiveness data

Steps	Probe Session Numbers of Participants					
	DS 1	DS 2	DS 3	IG 1	IG 2	IG 3
1. She/he can recognize/show the vacuum cleaner.	+	/	/	+	/	/
2. She/he can recognize/show the body of vacuum cleaner.	-	/	/	-	/	/
3. She/he can recognize/show the power on/off button.	-	/	/	+	/	/
4. She/he can recognize/show the power cord and power cord plug.	+	/	/	-	/	/
5. She/he can recognize/show the button to rewind cord.	-	/	/	-	/	/
6. She/he can recognize/show the pipe.	-	/	/	-	/	/
7. She/he can recognize/show the floor brush.	-	/	/	-	/	/
8. She/he can recognize/show the inhalant pipe (handle part).	-	/	/	-	/	/
9. She/he can show the socket in the room.	+	+	+	+	+	+
10. She/he can pull the power cord from the plug.	+	+	+	+	+	+
11. She/he can plug in the power cord.	-	+	+	+	+	+
12. She/he can control/gather belongings not to be swept .	-	/	/	-	/	/
13. She/he can press the power-on button.	-	-	+	+	+	+
14. She/he can hold the pipe.	+	-	+	+	+	+
15. She/he can sweep carpet by moving the pipe back and forth.	+	-	+	+	+	+
16. She/he can press the power-off button.	+	-	+	-	-	-
17. She/he can unplug the power cord.	+	-	+	-	+	+
18. She/he can press the button to rewind cord.	-	-	+	-	+	+
Percentage	44	33	100	44	89	89

"-": Not completed; "+": Completed successfully; "/": Not measured

According to Table 4.8 and 4.9, step numbers of SCV skill are decreased together with changes in application. In the pilot version of the application, there are two main sections which "Parts of vacuum cleaner" and "Sweeping carpet". "Parts of vacuum cleaner" section was removed in the new version of tablet application. Moreover, some unnecessary steps from sweeping section were removed. Since, pilot study data indicates that although participants learned the sweeping skill, they had difficulties to show the parts of vacuum cleaner. Participants in pilot study could not match names and real parts of vacuum. However, when they studied with the tablet application, they could match the picture shown in tablet and real object (part of vacuum). For example, participants could not show the floor brush or pipe when their names were said, but they were able to use floor brush or pipe properly.

Table 4.9 Participants' Success Level According To Skill Steps in Main Study (After Changes in Application) - Effectiveness Data

Steps	Probe Sessions of Participants										
	OA 1	OA 2	OA 3	KE 1	KE 2	KE 3	BG 1	BG 2	BG 3	BG 4	BG 5
1. She/he can pull the power cord from the plug.	-	+	+	-	-	+	-	-	-	+	+
2. She/he can show the socket in the room.	-	+	+	-	-	+	-	-	-	+	+
3. She/he can plug in the power cord.	-	+	+	-	-	+	-	-	-	+	+
4. She/he can press the power-on button.	-	+	+	-	-	+	-	-	-	+	+
5. She/he can hold the pipe.	-	+	+	-	-	+	-	-	-	+	+
6. She/he can sweep carpet by moving the pipe back and forth.	+	+	+	+	+	+	+	+	+	-	+
7. She/he can press the power-off button.	-	+	+	-	-	+	-	-	-	+	+
8. She/he can unplug the power cord.	-	+	+	-	-	+	-	-	-	+	+
9. She/he can press the button to rewind cord.	-	+	+	-	-	+	-	-	-	+	+
10. She/he can move the vacuum on its own place.	-	-	+	-	-	+	-	-	-	+	+
Percentage	10	90	100	10	10	100	10	10	10	90	100

"-": Not completed; "+" : Completed successfully

Table 4.10 Differences in Baseline Sessions' Success Rate between Pilot Study and Main Study (Effectiveness)

Before Changes in Application (Pilot Study)			**After Changes in Application (Main Study)**		
Code of Part.	**# Baseline Sessions**	**% Correct Responses**	**Code of Part.**	**# Baseline Sessions**	**% Correct Responses**
DS	1.Baseline	6	OA	1.Baseline	10
DS	2.Baseline	33	OA	2.Baseline	10
DS	3.Baseline	22	OA	3.Baseline	10
IG	1.Baseline	28	KE	1.Baseline	10
IG	2.Baseline	33	KE	2.Baseline	10
IG	3.Baseline	28	KE	3.Baseline	10
			KE	4.Baseline	10
			BG	1.Baseline	10
			BG	2.Baseline	10
			BG	3.Baseline	10
			BG	4.Baseline	10
			BG	5.Baseline	10
	Mean:	25		Mean:	10

: Number of ; % : Percentage of

Table 4.11 Differences in Probe Sessions' Success Rate between Pilot Study and Main Study (Effectiveness)

Before Changes in Application (Pilot Study)			**After Changes in Application (Main Study)**		
Code of Part.	**# Probe Sessions after Intervention**	**% Correct Responses**	**Code of Part.**	**# Probe Sessions after Intervention**	**% Correct Responses**
DS	1. Probe	44	OA	1. Probe	10
DS	2. Probe	33	OA	2. Probe	90
DS	3. Probe	100	OA	3. Probe	100
IG	1. Probe	44	KE	1. Probe	10
IG	2. Probe	89	KE	2. Probe	10
IG	3. Probe	89	KE	3. Probe	100
			BG	1. Probe	10
			BG	2. Probe	10
			BG	3. Probe	10
			BG	4. Probe	90
			BG	5. Probe	100
	Mean:	66.5		Mean:	49.1

All participants' general success rate in probe sessions, which realized after each intervention session are presented in Table 4.11. General mean of pilot study (66.5%) is higher than general mean of main study (49.1%). Since, participants are already more successful in baseline sessions of pilot study (25%) than main study (10%) as shown in Table 4.10. Although, participants' intellectual disability level are similar between pilot study and main study, the basis reason of this difference is that "parts of vacuum cleaner" section is placed in the application which is used in the pilot study. In the pilot study, participant already knew the names of some parts of vacuum cleaner (such as plug, socket etc.) when they started the baseline sessions, so their baseline success rate is higher than main study.

Table 4.12 Differences in Time of Intervention Sessions between Pilot Study and Main Study (Efficiency)

Before Changes in Application (Pilot Study)			**After Changes in Application (Main Study)**		
Code of Participant	**# Intervention Sessions**	**Time of Intervention Sessions (min)**	**Code of Participant**	**# Intervention Sessions**	**Time of Intervention Sessions (min)**
DS	1.Intervention	11.30	OA	1.Intervention	6
DS	2.Intervention	10	OA	2.Intervention	6.23
DS	3.Intervention	6.13	OA	3.Intervention	4.55
IG	1.Intervention	13.41	KE	1.Intervention	5.40
IG	2.Intervention	8.15	KE	2.Intervention	5.36
IG	3.Intervention	8.20	KE	3.Intervention	5.40
			BG	1.Intervention	10
			BG	2.Intervention	6.19
			BG	3.Intervention	6.08
			BG	4.Intervention	5.05
			BG	5.Intervention	5
	Mean:	10		Mean:	6.42

#: Number of

As indicated in Table 4.12, there is a significant advance in the mean spent time for intervention sessions after pilot study. While participants in the pilot study completed intervention sessions in averagely 10 minutes, after changes in application most of the participants in main study completed intervention sessions in averagely 5-6 minutes. In the main study, only one participant (BG) completed the first intervention session in 10 minutes. It took time for her to get used to the application because she had shy and timid characteristic features. After BG got used to the process, she completed the intervention sessions in 5-6 minutes like other participants. In addition, the amount of time spent for the intervention sessions

decreased for each student. For example, first intervention session of DS was 11.30 minute, second one was 10 minute and last intervention session was 6.13. Similarly, other participants' time spent for intervention sessions decreased too. Therefore, this is an important efficiency result, after participants got used to the tablet application, the amount of time spent for intervention sessions decrease. This achievement can be beneficial for participants with limited attention time. Finally, efficiency data shows that changes in the tablet application decreased a significant amount of time spent for intervention. It is very important for individuals with ID who are able to focus attention for a limited time, also for teachers who need to spend less time for one student's training.

4.7 Summary of the Results

Results are presented in five titles: effectiveness, maintenance and generalization, reliability, social validity and usability data. According to effectiveness data, all three participants performed averagely 10% correct responses during baseline sessions. They performed only one same step (hold the pipe, move back and forth) right in all sessions; they could not perform other steps of the skill. After three intervention sessions, OA and KE performed all steps of sweeping carpet with a vacuum correctly (100%). BG learned the skill completely (100%) after five intervention sessions. After the second intervention session, BG did not come to rehabilitation center for one session. Therefore, she might have forgotten the newly learned knowledge and she had to attend more intervention sessions than other participants did.

According to maintenance data, three participants (OA, KE, BG) complete all tasks (100%) correctly at one, three and four weeks after intervention sessions. It shows that participants sustain the newly learned skill after the intervention process. In terms of generalization, three participants (OA, KE, BG) perform the sweeping ability with 100% accuracy levels by using different tools (vacuum cleaner and carpet).

In order to assess the inter-observer reliability, two different observers coded participants’ response for 30% of all session types (baseline, probe, follow-up and generalization). The consensus between two observers was 100% for all participants

and all session types. Procedural fidelity data shows that practitioner performed the probe, follow-up and generalization sessions with 100% accuracy level and intervention sessions with 98% accuracy level. In order to assess the reliability of the interview coding two different researchers coded the interview transcript. The agreements between coders were at 100% for themes, at 91% for sub-themes.

According to social validity data, teachers' satisfaction level about the SCV application has the highest average points (4.77). All teachers think that students had a good time with the SCV application and all of teachers want similar products to be developed. (5.0). Teachers' views about tablet usage in education were categorized under five themes as following: (1) Experience (2) Attitude (3) Training about tablet usage (4) Perceived easiness (5) Institutional support. Teachers' views about SCV tablet application were summarized under six theme as following: (1) Effectiveness (2) Usefulness (3) Enjoyment (4) Easiness (5) Attitude (future use) (6) Properties need to be changed.

Usability of two version of the SCV application (pilot version and main version) was examined in terms of effectiveness, efficiency and satisfaction. Effectiveness data shows that after the intervention sessions, general mean of pilot study (66.5%) is higher than general mean of main study (49.1%). Participants are already more successful in baseline sessions of pilot study (25%) than baseline sessions of main study (10%). For both versions, general difference between baseline and intervention sessions is almost 40%. Thus, there is no significant increase in terms of effectiveness. However, efficiency data shows that changes in the tablet application decrease the significant amount of time spent for intervention (it decreases from 10 minutes to 5-6 minutes). In addition, time of intervention sessions decreases for each participant. After participants got used to the tablet application, the amount of time spent for intervention sessions decreases and it can be beneficial for participants with limited attention time. Another factor of usability is satisfaction. Satisfaction data was presented as a social validity data. All special education teachers explain positive views about tablet usage and application.

CHAPTER 5

DISCUSSION AND CONCLUSION

The aim of this dissertation is to provide a research-based guidance about successful mobile technology integration in special education field to administrators, decision makers, teachers and key stakeholders who work in special education field. More specifically, the present study examines the effectiveness of interactive tablet applications designed on daily living skills for individuals with ID, and determine if there is an increase in the success level of individuals with ID. Furthermore, it is explored that whether the persistence of these newly learned skills is protected at one, three and four weeks after training finished. In addition, the generalization of this skill with different tools is examined. Finally, social validity and usability issues about the educational tablet application are explored from the perspective of special education teachers. By doing this study, it is aimed to shed light on the successes and challenges encountered in the process of mobile technology integration in special education field.

A single-case research design was performed in the scope of this dissertation study. SCRD is not a case study approach; it is a quantitative experimental research approach. One of the most common SCRD is the multiple-baseline design. Multiple-baselines across subjects design was used as single case research. In addition, five kinds of data were collected: effectiveness, reliability, social validity, maintenance and generalization, and usability. Finally, both qualitative and quantitative structured data, which require parallel analysis techniques, were used together.

To summarize, results show that (1) using educational interactive tablet application to teach a daily living skill for individuals with ID is (a) effective, (b) after 1, 3 and 4 week from the intervention, individuals with ID sustain the newly learned skill successfully, (c) also they are able to generalize this new skill to different vacuum cleaner and carpet, (2) teachers of individuals with ID reported positive views about the social validity of study, (3) Changes made in pilot version of SCV application revealed positive results in terms of usability.

5.1 Effectiveness of SCV Application

Three participants (OA, KE and BG) who have similar disability type, disability rate, IQ level, age, gender and socioeconomic status exhibited similar correct responses and similar effectiveness data. All participants responded 10% of all steps correctly in all baseline sessions (before intervention). They performed only one same step (moving pipe back and forth) correctly; they could not perform other steps of skill. Their previous experience about vacuum cleaner may have a significant effect on this result. Because, they saw their parents while they were moving pipe of vacuum back and forth at home. They have no experience about how vacuum cleaner starts to work.

After baseline sessions, intervention sessions started. Probe sessions and intervention sessions were continued until three consecutive probe sessions meet the 100% criteria. OA and KE learned to sweep carpet with vacuum (meet the 100% criteria) after three intervention sessions similarly. BG learned to sweep carpet with vacuum after five intervention sessions. It is thought that there are two main reasons for long and numerous intervention sessions of BG: (1) after the second probe session, BG did not come to rehabilitation center for one session. So, she might have forgotten the newly learned information, and other reason is that (2) BG is a shy girl as a character property, so it takes time to get used to training with the tablet a bit more compared to others.

The current effectiveness data supports previous studies suggesting the effectiveness of educational mobile technology usage in improving the skills (academic, communication, employment, leisure and transitioning skills etc.) of individuals with

special education need (Fernandez-Lopez et.al, 2013; Van Laarhoven et al.,2009; Burke et al.,2010; Kagohara et al.,2011; Cihak et al, 2010; Flores et al.,2012).

Similar studies about mobile technology usage in improving daily living and employment skills of students with special needs are presented. Van Laarhoven et al. (2009) used iPods for developing daily living skills (cleaning the bathroom, mopping the floor/ emptying garbage and cleaning kennels) for 17 years old male with 1p36 Deletion syndrome and intellectual disability. The results suggest that the use of an iPod, involving video and audio prompting tools, is effective for increasing task completion capability for daily living skills. Burke et al. (2010) gave fire safety training to six participants with ASD by using iPods. They suggest that a cueing system, which is presented by an iPhone and an iPod Touch was an effective form of prompting an employment setting.

The effectiveness results of studies about mobile technology usage in improving communication skills of students with special needs are summarized. Kagohara et al. (2010) study with a 17 years old boy with autism to use an iPod Touch to request snacks. This study suggested that using iPod-based speech generating device (SGD) was effective in shaping the participants' response topography. Similarly, van der Meer et al. (2011) aimed at teaching three individuals with developmental disabilities to request snacks and toys using an iPod touch. The study showed that using an iPod based SGD to request snack and toy was successful for teaching two of three participants. Kagohara, van der Meer et al. (2012) studied with two students with developmental disabilities to name educationally relevant pictures by using iPod touch and iPad. It is suggested in the study that they can successfully participate in a picture naming exercise by using an iPad an iPod touch as a SGD. Van der Meer, Didden et al. (2012) stated that using iPod based SGD was effective in teaching targeted manual signs and SGD responses to three of four students, whereas one child only learned to use the SGD. van der Meer, Kagohara et al. (2012) told that all four children learned to use the picture-exchange system and the iPod touch, only two also learned to use manual signs. van der Meer, Sutherland, et al. (2012) stated that three of the four children showed a preference for using the iPod Touch.

The effectiveness results of studies about mobile technology usage in improving leisure skills of students with special needs are summarized. Hammond et al. (2010) aimed to teach three participants with intellectual disabilities how to watch a movie, listen to music and look at pictures on a iPod Nano. The results of the study suggest that video modeling delivered on a laptop was an effective method for teaching individuals with ID to operate iPod Nano for leisure activities. Kagohara (2011) aimed to teach three students with ID to operate an iPod Touch to watch movies. Results showed that video modeling delivered on an iPod Touch was an effective in teaching to operate an iPod touch to watch movies. In another study, Kagohara et al. (2011) intended to teach three students with ID to play music on an iPod Touch. The results suggest that video modeling can be an effective teaching procedure for teaching students with ID to operate an iPod to play music.

5.2 Maintenance and Generalization of Newly Learned Knowledge

Follow-up sessions were carried out for measuring maintenance in this study. Three participants (OA, KE, BG) complete all tasks (100%) correctly in three follow-up sessions. It shows that participants sustain the newly learned skill after intervention sessions. Researcher met with DS (participant of pilot study) again during the implementation process of main study. After the pilot study, it passed approximately four months. Despite the long time passed over interventions, DS complete all tasks correctly. It shows that participants did not forget sweeping with vacuum after intervention finished.

In generalization sessions, three participants (OA, KE, BG) complete all tasks correctly by using different vacuum cleaner and different carpet. It shows that participants are able to generalize the newly learned skill to different tools. They may sweep their carpet with their own vacuum cleaner.

Similarly, van Laarhoven et al (2009) stated that student with Deletion syndrome and ID protected the newly learned daily living skill (cleaning the bathroom, mopping the floor and cleaning kennels) using an iPod at 10-week follow-up session. Performance remained at 89% correct. It shows that use of an iPod to teach a daily living skill provides sustainable knowledge. In addition, Burke et al. (2010) presented that

performance (fire safety training by iPod) remained high during follow-up sessions and generalization sessions.

Overall, this dissertation study provides evidence that educational tablet applications can be successfully utilized within educational programs targeting daily living skills for individuals with intellectual disabilities.

5.3 Reliability of the Study

In this study, three types of reliability data were collected. These are inter-observer reliability, procedural fidelity and inter-coder reliability data. Inter-observer reliability data shows that two independent observer agreements were 100%. There was no doubt lived during the coding. Since, steps are clear and different from each other. Observer could code each step easily.

Procedural fidelity data shows that actual practice was carried out conveniently to intended practice. Researcher performed all sessions with almost 100% accuracy level. Only intervention sessions were carried out with 98% accuracy level.

In order to assess the reliability of the interview coding two different researchers coded the interview transcript. The percent agreements between coders were 100% for themes, 91% for sub-themes.

5.4 Social Validity of the Study

In this part, three types of data were presented as following: teachers' satisfaction survey about SCV application, teachers' view about educational tablet usage and SCV application. Teachers' satisfaction factor about the SCV application is quite fine. All teachers think that students have a good time with SCV application and they want to use similar products to SCV application to be developed. Controllability and design factors of the SCV application also won the appreciation of teachers. They think that this application can be used easily in the classroom and at home, they think that it is useful for students.

Teachers' views about educational tablet usage are asked. They stated that almost no teacher have used tablets with educational purpose in lessons. They used their personal mobile phones instead of tablets. Mobile phones are generally used for basic games and painting. Despite their little experience, their attitudes to tablets are very positive. They want to use tablets in their lessons, because they stated that tablets could increase the children's attention and keep their attention for longer time. Similarly, Fernandez-Lopez and colleagues (2013) stated that the use of electronic devices and multimedia content increases their interest in learning. However, special education teachers expressed that they want to take training about educational usage of tablets. Because they want to vary their learning activities with students, they think that it would be useful for their students.

In addition, special education teachers stated about perceived easiness of tablet usage in education that difficulty and ease terms could change according to every student in special education field because of individual differences. In addition, they said that after short adaptation process, students were able to use the tablet easily in everywhere (at school, home etc.). Correspondingly, many sources in literature explained that the special need students can learn anytime and anywhere with the help of the mobility of these devices (Fernandez-Lopez et al., 2013). Teachers compared computers and tablets in terms of convenience for students with ID. They said that using tablet is easier than using computer because of their touch screen feature. While using computers, students have to press buttons and move mouse. This is more complex for students with special needs. Finally, institutional support was asked them, their institution does not provide tablets to use in lessons, as an alternative they use their mobile phones. One teacher as the director of the institution said that there is no institutional support because the number of available applications for special education field is not enough. Even if tablets are provided for teachers, they cannot find enough available application for executing on tablets.

Teachers' views about the SCV application are asked. They said that SCV application is effective since it provides audio and visual stimuli such as cartoons, so it draws attention of children. According to Leroy and De Leo's (2013) Microsoft research about visualization property of mobile devices, picture-based communication helps

many children with moderate or severe autism to compensate their limited verbal skills. Also in this study, special education teachers said that it is very effective for students with ID to make practice with real materials in the learning process. Teachers found SCV application very useful; it helps to increase students' technologic skills and time on focus. However, SCV application helps to develop motor skills and support self-confidence. Being able to accomplish tasks by themselves increases their self-confidence and independences. In literature, a mother shares her experience of how an iPad change the life of her son with Autism. After spending time using iPad, his mother notice signs of independence in her son. He was able to do something, which he previously could not; also, his violent behaviors were decreased with the help of the iPad (Harrell, 2010).

Teachers stated that SCV application is useful to save time for them. Teachers expressed their opinions about enjoyment aspect of SCV application such that students enjoyed using the tablet application because it is a different method and very interesting for them. Correspondingly, Lopez, Fortiz and Garcia (2009) pointed out that the use of mobile technologies and multimedia increases the interest of students, helping them to learn while they are entertaining. According to teachers, learning the use of application is easy for students with ID. They added that easiness term change according to each student with special need because of their individual differences. So, in the case of students with special needs, learning exercises should be individualized in order to meet their special needs (Lopez et al, 2009). Their attitudes are very positive; they would like to use SCV application in the future.

5.5 Usability of SCV application

Usability results are very important for designing better applications with good user interface features for individuals with ID. In the field of special education, the instructional features of tablet applications have been emphasized and considered as critical factors to improve the skills of students with intellectual disabilities (Seo & Bryant, 2009). Beyond the instructional features, the user interface design features of computer programs are also critical because the instructional features can be

effectively delivered depending on how the interface of programs is designed (Seo & Woo, 2010).

Usability results give important information about effectiveness, efficiency and satisfaction. Some changes were made in some screens of SCV application after the pilot study. Two version of SCV application (pilot version and main version) are compared according to usability components (effectiveness, efficiency and satisfaction).

Participants' success level in skill steps are analyzed as effectiveness data for main study and pilot study. Percentage of correct steps increased at same rate in both study. Average percentage of baseline sessions for pilot study 25% increased to 66.5% after intervention sessions. Similarly, average percentage of baseline sessions for main study 10% increased to 49.1% after intervention sessions. An amount of increase for both is approximately 40%. There is no significant difference between two versions in terms of effectiveness. The learning of students is similar with both version of application. However, Seo and Woo (2010) conducted the usability study to assess whether the interface of Math explorer was well designed for students with LD to facilitate their mathematical word problem solving performance. According to results of the study, the critical user interface design features in computer programs would be essential for facilitating the learning of students with LD (Seo &Woo, 2010).

Participants' time to complete the intervention sessions were calculated for pilot version and main version of SCV application. While participants in pilot study completed intervention sessions in averagely 10 minutes, after changes in application most of the participants in main study completed intervention sessions in averagely 5-6 minutes. There is a significant advance in terms of the mean of spent time for intervention sessions after changes in SCV application. Efficiency data shows that changes in the tablet application decrease the significant amount of time spent for intervention. It is very important for individuals with ID who can be able to focus attention for limited time, also for teachers who have a limited lesson time with them. Teachers can teach only main and important steps for sweeping skill.

Similarly, Pennington and colleagues (2010) stated that the use of computer-assisted instruction required minimal instruction time; this is critic in that many young children with autism may not have the prerequisite skills to engage in instructional activities for long periods of time. However, changes in SCV application decrease the workload of teachers, since unnecessary steps are removed and step numbers decrease.

Satisfaction results about SCV application also showed that teachers like this application and they want to use this application and similar products in their lessons. Teachers stated that SCV application is an effective tool for special education students since it has visual and audio support; it is more effective than orally presented information. Teachers explained the benefits of SCV application as following: increases the technologic skills by using tablets, increases time of focus, develops motor skills, supports self-confidence, saves time of teacher and parents are willing.

Finally, as Clark (1983) pointed out in his media research, the tablet is not a factor that improves students' learning, but it is only a medium to deliver instruction. The instructional principles and features embedded in the tablet application are critical factors closely related to students' positive outcomes (Clark, 1983). Instructional features of tablet applications should be improved and personalized for students with special needs.

5.6 Responses of Research Questions

Research Question 1: Does the educational tablet application contribute to learn daily living skills for individuals with ID?

Effectiveness results show that educational tablet application designed to teach sweeping carpet with vacuum cleaner for individuals with ID is effective. Baseline sessions were performed before intervention sessions. In baseline sessions, the correct response percentages of all participants were 10%. After intervention sessions, three participants with ID of main study and two participants with ID of pilot study performed the ability of sweeping carpet with vacuum all steps correctly.

OA and KE learned the skill after three intervention sessions, and BG learned after five intervention sessions completely. Therefore, it can be inferred that educational tablet application contributes to learn daily living skills for individuals with ID.

Sub-question 1.1: How is the persistence of the newly learned skill at one, three and four weeks after training finished?

The persistence of the newly learned skill is protected at one, three and four weeks after training finished. All participants of the study performed to sweep carpet with vacuum 100% correctly at one, three and four weeks after training finished. For this reason, it can be inferred that instruction with the tablet application for individuals with ID is successful in terms of sustainability.

Sub-question 1.2: How is the generalization of the newly learned skill in different tools?

All participants of the study can generalize the skill of sweeping carpet with vacuum to different vacuum cleaner and different carpet. Therefore, it can be concluded that participants are able to generalize the newly learned sweeping skill to different tools.

Research question 2: What are the usability issues of educational tablet application for individuals with ID in terms of effectiveness, efficiency and satisfaction?

According to usability results, educational tablet application was investigated in terms of effectiveness, efficiency and satisfaction. Application updated after the pilot study. The number of steps and time of application decreased after the changes. There was no significant difference between two versions of tablet application (before pilot version and after pilot version) in terms of effectiveness. However, efficiency data shows that changes in the tablet application decrease the significant amount of time spent for intervention. It is very important for individuals with ID who can be able to focus attention for limited time, also for teachers who have a limited lesson time with them. Also, after participants got used to tablet application, the amount of time spent for intervention sessions decrease in itself for each participant and it can be beneficial for participants with limited attention time.

According to teachers' views about SCV application and observation of researcher, all participants with ID like the tablet application and enjoy when they are using tablet application. Tablet application attracts their attention and keeps their attention for longer time in lesson. Visual and audio content of the application help to attract their attention. One teacher stated, "To be able to do something independently increases their self-confidence. We observed happiness and excitement in the eyes of children." Reactions of individuals with ID are very good to tablet application.

Research Question 3: What are the views of special education teachers about the utilization of educational tablet application? What is the graded rate of special education teachers' satisfaction about educational tablet application? (Social validity)

According to graded rate of teachers' satisfaction, their satisfaction about the SCV application has the highest points. All teachers gave highest points to statements which students have a good time with the SCV application and all of teachers want similar products to be developed.

Five special education teachers' views about tablet usage and SCV application were taken via interviews. Despite of the fact that teachers have never used tablets with educational purpose in their lessons, their attitudes to tablets are very positive. They want to use tablets in their lessons. According to teachers' views about SCV tablet application, (1) in terms of effectiveness, most of special education teachers stated that application is effective since visual and audio content is presented together, also it is very effective to make practice with real materials. (2) Special education teachers expressed that SCV tablet application is useful, because students gain new technological skills, motor skills and tablets increases students' limited focusing time and their self-confidence. Another useful aspect of SCV application is that it saves time of teachers. (3) Special education teachers stated that SCV tablet application is enjoyable, since this is a different method and interesting for them. (4) Special education teachers stated that SCV tablet application is easy, because difficulty level of application is suitable for children who have prerequisite behaviors. (5) In terms of attitude, all teachers in the study told that they would like to use SCV application in future. Teachers found this application as enjoyable, interesting and useful for

their students. (6) Special education teachers expressed some properties need to be changed for pilot version of application. Those properties were changed after pilot study. Some of teachers said that there is no parts need to be changed in application.

5.7 Novelty of the Study

This study is one of the few studies in which mobile technologies are used for special education field in Turkey and is pioneering with the aspect of using tablet application to teach daily living skills to individuals with ID.

Sweeping carpet with vacuum cleaner is a daily living skill that requires a student to stand up and actively move. With the help of mobility and flexibility features of tablets, the students continued the training while standing up and keeping the position without interruption. Especially, individuals with ID having problems with moving quickly and focusing benefited from training with tablet application. Furthermore, mobility feature of tablets can gain more importance in the context of daily living skills requiring more movements like floor cleaning (needs to go to bath and come back to the room).

Another advantage of this study is that the tablet application used in the study is developed according to the needs of special individuals under the supervision of special education experts and instructional technologists in the scope of the TUBITAK supported project. In this study, the tablet application was updated according to the results of usability test and heuristic evaluation, and was enhanced in terms of efficiency and satisfaction. This study reveals that there is a need for tablet applications, which are well-designed and meet needs of special students.

One of advantages of the study is that it decreases workload of special education teachers and it allows students study independently from location and time. In the traditional education methods, sweeping carpet with vacuum cleaner skill can be taught to the student by the teacher demonstrating how it is done, but this needs more time and effort. The tablet application used in the study decreased the workload of the special education teachers and the time needed for education. This is an important advantage for students spending limited time in the rehabilitation center.

Furthermore, the parents of the students can be allowed to access the tablet application to continue education after school time and free from location.

5.8 Practical Implications for Special Education Teachers/ Practitioners

The results of the study reveal several practical implications for individuals who work in special education field. Special education teachers/ practitioners can teach the skill of sweeping carpet with vacuum by using tablet application in their lessons. While using application, it is recommended to follow these steps (Turkish version is also presented in Appendix N):

(1) The application is suitable for students who met the following requirements: (a) ability to follow simple verbal instructions (sentences consist of minimum five words), (b) directing attention to an event for least 10 minutes, (c) ability to imitate motor skills, (d) ability to use hands and fingers, (e) ability to point out the answer by using his/her finger or to answer verbally (f) absence of any physical dysfunction or health condition.

(2) Practitioner should remove distracting stimuli from the environment.

(3) Practitioner should tell the subject to be studied.

(4) Practitioner should give the sign of attention before start to watch application.

(5) Practitioner should display the corresponding scene from tablet for each step of skill. Step by step principle is suggested for training sessions. If students watch all steps nonstop from beginning to end, they can forget the first step of the skill during practice. So, it is recommended that each step of skill is displayed from tablet and perform it after watching.

(6) Practitioner should attract attention of student if attention distributed during watching application.

(7) Practitioner should give the corresponding instruction for each step of skill after watching corresponding scene. It should be asked to perform the each step.

(8) Practitioner should wait the response range.

(9) If student give correct answer, practitioner may give reinforcement to student. If student give wrong answer, practitioner should express “Got Wrong” as error correction and return student to former position. In addition, practitioner should display the same scene again from tablet. If student do not give response, practitioner should return student to former position and display the same scene again from tablet.

Practitioner should repeat this process until all steps of skill finished. According to results of the study, after three consecutive training sessions, it is expected that students with ID have learned the skill of sweeping carpet with vacuum by using tablet application.

5.9 Limitations of the Study

Limitations of the study were listed in this section:

(1) This study was investigated with only three participants with ID. Intervention was carried out to teach only one skill (sweeping carpet with vacuum). This situation may affect the external validity or generalization of the study negatively. There is a need for studies, which investigate the effectiveness of method and different tablet applications with different students who have different type of disability to improve different kind of skills (communication, academic, leisure, another daily living skill etc.).

(2) To measure performance of participants, probe sessions are designed by using “single opportunity” probe procedure. In this procedure, if participant make an error on the first step of the skill, the session is terminated. “Single opportunity” probe condition has advantages for decreasing error level but it does not give an opportunity to perform all steps. It is possible that the student is simply unable to perform the first step of the task analysis, but can perform some or even all subsequent steps (Gast & Ledford, 2010).

5.10 Suggestions and Implications for Future Research

Mobile devices are becoming more powerful, less expensive, and more ubiquitous. However, there is a lack of study about effectiveness of mobile devices in the special education field. Especially, studies, exploring effectiveness of mobile devices (tablets, smart phones etc.), producing new applications according to usability guides for individuals with special needs and innovative instruction methods for special students to be administrated might be priority topics of research in this context.

Success in learning to use technological devices seemed largely to depend on the use of well-established instructional procedures and instructional applications. Due to a limited number of studies addressing the user interface design of tablet applications for students with ID, several interface design features for students with ID could not be specified in this study. More studies about usability of tablet applications for special students are necessary.

Results of this dissertation study show that using interactive tablet applications in the education of individuals with ID is an effective method to improve their daily living skills. For this reason, new education environments for students with ID should be designed with support of innovative technological devices. Rehabilitation centers or special education schools should support their teachers and students with new technological devices.

This study was carried out with five individuals with intellectual disability for teaching to sweep carpet with vacuum cleaner. The effectiveness of method and different tablet applications can be investigated with students who have different type of disability to improve different kind of skill (communication, academic, leisure, another daily living skill etc.).

REFERENCES

Abbeduto, L., Murphy, M. M., Richmond, E. K., Amman, A., Beth, P., Weisman, M. D., Karadottir, S. (2006). Collaboration in referential communication: Comparison of youth with Down syndrome or Fragile X syndrome. American Journal on Mental Retardation, 111, 170-183. Doi:10.1352/0895-0817

Acungil, A.,T. (2014). Zihin yetersizliği olan öğrencilere görsel-işitsel teknolojilerle sunulan tablet bilgisayar öğretim programinin etkililiği. Anadolu University. Master Thesis.

Affleck, J., Edgar, E., Levine, P., & Kortering, L. (1990). Post school status of individuals classified as mildly mentally retarded, learning disabled, or nonhandicapped: Does it get better with time? Education and Training in Mental Retardation, 26, 142-150.

Akkoyunlu, B. & Yılmaz, M (2005) Türetimci çoklu ortam öğrenme kuramı. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi , 28, 9-18.

Akmanoğlu, N. (2008). Otistik Çocuklara Kötü Niyetli Yabancı Kişilerin Kaçırma Girişimlerinden Kaçınmayı Öğretme, . Dissertation. Eskişehir: Anadolu Üniversitesi Eğitim Bilimleri Enstitüsü.

American Association on Intellectual and Developmental Disabilities. (2010). Intellectual Disability: Definition, Classification, and Systems of Supports (11nd ed.). Washington, DC: Author.

American Psychiatric Association (2000). Diagnostic and statistical manual of mental disorders 4th Edition.

Armutçu, O. A. (2008). Zihinsel yetersizlikten etkilenmiş öğrencilere word belgesi üzerine yazi yazma becerisinin kazandirilmasinda eşzamanli ipucu işlem süreci ile yapilan öğretimin etkililiği. Gazi University. Master Thesis.

Aruk, İ. (2008). Bilişim teknolojilerinin zihinsel engellilerin e-eğitiminde kullanilmasi ve örnek bir uygulama geliştirilmesi. Trakya University. Master Thesis.

Ayres, K. M., Maguire, A., McClimon, D. (2009). Acquisition and Generalization of Chained Tasks Taught with Computer Based Video Instruction to Children with Autism. Education and Training in Developmental Disabilities, 44 (4), 493-508.

Baer, D.M., Wolf, M. M. & Risley T.R. (1968). Some current dimensions of applied behavior analysis. Journal of Applied Behavior Analysis, 1, 91-97.

Başal, M. & Batu, S. (2003). The perspectives of Self-Contained Class Teachers about Teaching Reading and Writing to Students with Mental Retardation, Özel Eğitim Dergisi. 3, 85-98.

Başoğlu, E., D. (2009) Zihinsel engelli öğrenciler için bir eğitim yazılımının geliştirilmesi, uygulanması ve değerlendirilmesi. Sakarya Univeresity. Master Thesis.

Beirne-Smith, M., Patton, J. R., & Kim., S. H. (2006). Mental retardation: An introduction to intellectual disability (7th ed.). Upper Saddle River, NJ: Merrill.

Bertini, E.,S., & Kimani, S. (2003). Mobile devices: opportunities for users with special needs. Mobile HCI. In L. Chittaro (Ed.). Lecture notes of computer science, Vol. 2795 (pp. 486–491). Springer Verlag.

Billingsley, F., White, O. R., & Munson, R. (1980). Procedural reliability: A rationale and an example. Behavioral Assessment, 2, 229-241.

Binger C (2008) Classroom-based language goals and intervention for children who use AAC: back to basics. Perspect Augment Altern Commun 17:20–26

Bozkurt, S. (2011). Otizmli Çocuklara Rol Oyun Becerilerinin Öğretiminde Akran ve Yetişkin Modelin Kullanıldığı Video Modelin Etkililiği ve Verimliliği. Master Thesis. Eskişehir: Anadolu Üniversitesi Eğitim Bilimleri Enstitüsü.

Brown, D. J., McHugh, D., Standen, P., Evett, L., Shopland, N., & Battersby, S. (2011). Designing location-based learning experiences for people with intellectual disabilities and additional sensory impairments. Computers & Education, 56, 11–20.

Brown, D. J., Powell, H. M., Battersby, S., Lewis, J., Shopland, N. & Yazdanparast, M. (2002). Design guidelines for interactive multimedia learning environments to promote social inclusion. Disability and Rehabilitation, 24 (11–12), pp. 587–97.

Burke, R.V., Andersen, M.N., Bowen, S.L., Howard, M.R., & Allen, K.D. (2010). Evaluation of two instruction methods to increase employment options for young adults with autism spectrum disorders. Research in Developmental Disabilities, 31, 1223–1233.

Butler, F. M., Miller, S. P., Lee, K.-H., & Pierce, T. (2001). Teaching mathematics to individuals with mild-to-moderate mental retardation: a review of the literature. Mental Retardation, 39, 20-31. doi: 10.1352/0047

Cannella, H. I., O'Reilly, M. F., & Lancioni, G. E. (2005). Choice and preference assessment research with people with severe to profound developmental disabilities: A review of the literature. Research in Developmental Disabilities, 26, 1–15.

Campbell, D. & Stanley, J. (1963). Experimental and Quasi-Experimental Designs for Research on Teaching. Rand McNally & Company

Cardon, T. A. (2012). Teaching caregivers to implement video modeling imitation training via iPad for their children with autism. Research in Autism Spectrum Disorders, 6(4), 1389-1400. doi:http://dx.doi.org/10.1016/j.rasd.2012.06.002

Cihak, D. Fahrenkrog, C., Ayres, K. & Smith, C. (2010). The use of video modeling via a video iPod and a system of least prompts to improve transitional behaviors for students with autism spectrum disorders in the general education classroom. Journal of Positive Behavior Interventions, 12 (2), 103-115.

Clark, R.E. (1983). Reconsidering Research on Learning from Media. Review of Educational Research, 53(4), 445-459.

Çağıltay, K. (2011). İnsan Bilgisayar Etkileşimi ve Kullanılabilirlik Mühendisliği - Teoriden Mühendisliğe. ODTU Yayıncılık, Ankara.

Çankaya, S. ve Kuzu, A. (2010). Investigating the characteristics of educational computer games developed for children with autism: a project proposal. In Proceedings of World Conference on Learning, Teaching & Administration 2010, Cairo, Egypt. 29-31 October.

Çatak, A. (2006). The effect of powerpoint software on educable mentally retarded students' reading comprehension skill. Abant İzzet Baysal University. Master Thesis.

Dalgın-Eyyip, Ö. (2011). Bilgisayar destekli etkinlik çizelgeleriyle sunulan öğretimin otizm spektrum bozukluğu gösteren çocukların çizelge izleme ve rol oyun becerilerini öğrenmedeki etkileri. Anadolu University. Master Thesis.

Dauphin, M., Kinney, E. M., & Stromer, R. (2004). Using video enhanced activity schedules and matrix training to teach socio-dramatic play to a child with autism. Journal of Positive Behavior Interventions, 6, 238–250.

Değirmenci, H. (2010). Zihinsel Yetersizliği Olan Bireylere Otel Kat Hizmetleri Becerilerinin Öğretiminde Videoyla Model Olma Stratejisinin Etkililiği. Master Thesis. Eskişehir: Anadolu Üniversitesi Eğitim Bilimleri Enstitüsü.

Demircioğlu, E. (2011). Engelliler ve İnsan–Bilgisayar Etkileşimi. Bilişim Sistemleri Ana Bilim Dalı, Bilişim Enstitüsü, Gazi Üniversitesi. http://engin.dempar.net/?p=41

Demirkıran, V. (2005). Özel eğitim kurumlarinda bilgisayar kullanimi ile özel eğitim mesle elemanlarinin bilgisayar destekli eğitime ilişkin görüşleri ile bilgisayar tutumlarinin belirlenmesi. Marmara University. Master Thesis.

Dillenbourg, P. (1999). What do you mean by "collaborative learning"? In P. Dillenbourg (Ed.), Collaborative-learning: Cognitive and computational approaches (pp. 1–19).

Dogan, S. (2015). Examining effects of a technology-enhanced extracurriculum on special education students with intellectual disability. Middle East Technical University. Master Thesis.

Drew, C. J., & Hardman, M. L. (2007) Intellectual disabilities across the lifespan (9th ed.). Columbus, OH: Merrill.

Edwards, B. J., Blackhurst, A. E., & Koorland, M. A. (1995). Computer-assisted constant time delay prompting to teach abbreviation spelling to adolescents with mild learning disabilities. Journal of Special Education Technology, 12, 301–311.

Fernández-Lopez, Á, Rodríguez-Fórtiz, M. J., Rodríguez-Almendros, M. L., & Martínez-Segura, M. J. (2013). Mobile learning technology based on iOS devices to support individuals with special education need. Computers & Education, 61(0), 77-90. doi:http://dx.doi.org/10.1016/j.compedu.2012.09.014

Flanagan, S., Bouck, E. C., & Richardson, J. (2013). Middle school special education teachers' perceptions and use of assistive technology in literacy instruction. Assistive Technology, 25(1), 24-30. doi:10.1080/10400435.2012.682697

Flores, M., Musgrove, K., Renner, S., Hinton, V., Strozier, S., Franklin, S. & Hil, D. (2012). A comparison of communication using the Apple iPad and a picture-based system. Augmentative and Alternative Communication, 28 (2), 74-84.

Gast, D.L. & Ledford, J.,R. (2014) Single Case Research Methodology: Applications in Special Education and Behavioral Sciences, Routledge, Second Edition.

Gast, D.L. & Ledford, J.,R. (2010). Single Subject Research Methodology in Behavioral Sciences. Routledge.

Genç, D. (2010). Otistik özellikler gösteren çocuklara eşzamanlı ipucuyla öğretimin yalnız sunulmasıyla video modelle birlikte sunulmasının karşılaştırılması. Master Thesis, Anadolu Üniversitesi, Eğitim Bilimleri Enstitüsü, Eskişehir.

Gibbert, M., W. Ruigrok, et al. (2008). "What passes as a rigorous case study?" Strategic Management Journal 29(13): 1465-1474.

Goldenberg, P.E. (1977). Special Technology for Special Children: Computers as Prostheses to Serve Communication and Autonomy in the Education of Handicapped Children. Paper presented at the Annual Meeting of the American Educational Research Association, New York

Goo, M. (2013). Effectiveness of using computer-based video instruction (CBVI) in teaching the location of grocery items to individuals with intellectual disabilities. PhD (Doctor of Philosophy) thesis, University of Iowa.

Gülsöz, T. (2014). Yüksek fonksiyonlu otizm özelliği gösteren öğrencilere soğuk içecek hazirlama ve sunma becerisinin video model ile öğretimin etkililiği. Necmettin Erbakan University Master Thesis.

Halisküçük, E. S. (2007). Zihinsel yetersizliği olan öğrencilere makarna pişirme becerisinin öğretiminde video modelinin etkililiği. Abant İzzet Baysal University. Master Thesis.

Hallahan, D. P., Kauffman, J. M., & Pullen, P. C. (2011). Exceptional Learners: An Introduction to Special Education (12th ed.). Boston, MA: Pearson.

Halpern, A. S. (1993). Quality of life as a conceptual framework for evaluation transition outcomes. Exceptional Children, 59, 486-498. Retrieved from http://sped.org/ [Last accessed on January 2015]

Hammond, D.L., Whatley, A.D., Ayres, K.M. & Gast, D.L. (2010) Effectiveness of video modeling to teach iPod use to students with moderate intellectual disabilities. Education and Training in Autism and Developmental Disabilities, 45, pp. 525–538

Hanaylı, M., Serbest, S. & Ürekli T. (2015). Otizmli Çocukların Sosyal Becerilerini Geliştirmeye Yönelik Android Uygulaması. www.mehmethanayli.com

Hardman, M.L., Drew, C. J., & Egan, M. W. (2007). Human exceptionality: School, community, and family (9th ed.). Boston, MA: Houghton Mifflin.

Harrell, A. (2010). iHelp for Autism. http://www.sfweekly.com/2010-08-11/news/ihelp-forautism [Last accessed on January, 2015]

Harrysson, B., Svensk, A. & Johansson, G. I. (2004) 'How people with developmental disabilities navigate the internet.' British Journal of Special Education, 31 (3), pp. 138–42.

Hasselbring, T. S.,& Williams, C. H. (2000). Use of computer technology to help individuals with special needs. Children and Computer Technology, 10(2), 102–122.

Holstein, J. (2012). Tablets for Autism. Tablet Computers Provide a Voice for the Autistic. ViewSonic Corporation

Horner, R.D. & Baer, D.M. (1978). Multiple-probe technique: a variation on the multiple baseline. Journal of Applied Behavior Analysis. Spring; 11(1): 189–196.

Hourcade, J. P., Williams, S. R., Miller, E. A., Huebner, K. E., & Liang, L. J. (2013). Evaluation of tablet apps to encourage social interaction in children with autism spectrum disorders. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Paris, France. 3197-3206. doi:10.1145/2470654.2466438

Hourcade, J., Bullock-Rest, N., & Hansen, T. (2012). Multitouch tablet applications and activities to enhance the social skills of children with autism spectrum disorders. Personal and Ubiquitous Computing, 16(2), 157-168. doi:10.1007/s00779-011-0383-3

ISO. ISO 9241-11: 1998, (1998). Ergonomic requirements for office work with visual display terminals (VDTs) - Part 11: Guidance on usability. Technical report, International Organization for standardization.

Kagohara, D. M., van der Meer, L., Ramdoss, S., O'Reilly, M. F., Lancioni, G. E., Davis, T. N. & Sigafoos, J. (2013). Using iPods® and iPads® in teaching programs for individuals with developmental disabilities: A systematic review. Research in Developmental Disabilities, 34(1), 147-156. doi:http://dx.doi.org/10.1016/j.ridd.2012.07.027

Kagohara, D.M., van der Meer, L., Achmadi, D., Green,V. A., O'Reilly, M. & Lancioni, G. E. (2012). Teaching picture naming to two adolescents with autism spectrum disorders using systematic instruction and speech-generating devices. Research in Autism Spectrum Disorders, 6, pp. 1224–1233.

Kagohara, D.M. (2011). Three students with developmental disabilities learn to operate an iPod to access age-appropriate entertainment videos. Journal of Behavioral Education, 20, pp. 33–43.

Kagohara, D.M., Sigafoos, J., Achmadi, D., van der Meer, L., O'Reilly, M., Lancioni, G. (2011). Teaching students with developmental disabilities to operate an iPod Touch to listen to music. Research in Developmental Disabilities, 32, pp. 2987–2992.

Kagohara, D.M., van der Meer, L., Achmadi,D., Green, V. A., O'Reilly, M. & Mulloy, A. (2010). Behavioral intervention promotes successful use of an iPod-based communication device by an adolescent with autism. Clinical Case Studies, 9, pp. 328–338

Kaiser, A. P., & Grim. J. G. (2006). Teaching functional communication skills. In M. E. Snell & F. Brown (Eds.), Instruction of individuals with severe disabilities (6th ed., pp.447-488). Columbus, OH: Merrill.

Kanpolat, Y. E. (2008). Otistik bireylere adı söylenen giysiyi gösterme becerisinin öğretiminde bilgisayar aracılığıyla sunulan eşzamanlı ipucuyla öğretimin etkililiği. Aban İzzet Baysal University. Master Thesis.

Karal, H. & Çiftçi, E. (2008). İşitme engelli bireylerin eğitim sürecinde bilgisayar destekli animasyonlardan yararlanma. 8th International Educational Technology Conference.

Karal, H., Özlü, A. & Kokoc, M. (2010) Teacher's and parent's opinions on the applicability of online teacher-parent meeting: two online parents' meeting implementings. Procedia Social and Behavioral Sciences. 9. 788–794

Karal, H., Kokoç, M. & Ayyıldız, U. (2010). Educational computer games for developing psychomotor ability in children with mild mental impairment. WCLTA 2010.

Karreman, J., van der Geest, V. & Buursink, E. (2007). Accessible website content guidelines for userswith intellectual disabilities. Journal of AppliedResearch in Intellectual Disabilities, 20 (6),pp. 510–8.

Kazdin, A. E. (1977). Assessing the clinical or applied importance of behavior change through social validation. Behavior Modification, 1, 427-452.

Kazdin, A. E. (1982). Single-case research designs: Methods for clinical and applied settings. New York: Oxford University Press.

Kazdin, A. E. (2011).Single-Case Research Designs, Second Edition. New York: Oxford University Press.

Kimball, J., Kinney, E., Taylor, B., & Stromer, R. (2004). Video enhanced activity schedules for children with Autism: A promising package for teaching social skills. Education and Treatment of Children, 27 (3), 280-298.

Kuzu, A. , Cavkaytar, A. , Odabaşı, H.F. , Erişti, S.D. & Çankaya, S. (2014). Development of mobile skill teaching software for parents of individuals with intellectual disability. Turkish Online Journal of Qualitative Inquiry, April 2014, 5(2)

Leroy, G. & De Leo, G. (2013). Mobile Device Uses the Images to Help Children with Autism Interact. Microsoft External Research.

Link, S. (2008). Teaching life skills - link autism leadership. Ipswich, MA: EBSCO Publishing. http://linkautism.com/PDFS/Teaching%20Life%20Skills.pdf [Last accessed on January, 2015]

Lombard, M., Snyder-Duch, J., Bracken, C.C., (2004). Practical Resources for Assessing and Reporting Intercoder Reliability in Content Analysis Research. Retrieved January, 2015

Lopez, A.F., Fortiz, M.J.R. & Garcia, M.N. (2009). Designing and supporting cooperative and ubiquitous learning systems for people with special needs. R. Meersman, P. Herrero, and T. Dillon (Eds.): OTM 2009 Workshop, LNCS 5872, pp.423-432.

Madsen, M., el Kaliouby, R., Goodwin, M., & Picard, R. (2008). Technology for just-in-time in-situ learning of facial affect for persons diagnosed with an

autism spectrum disorder. Proceedings of the 10th International ACM SIGACCESS Conference on Computers and Accessibility, Halifax, Nova Scotia, Canada. 19-26. doi:10.1145/1414471.1414477

Marks, G.,& Milne, J. (2008). iPod therefore I can: Enhancing the learning of children with intellectual disabilities through emerging technologies. Readings in Education and Technology: Proceedings of ICICTE 2008, 165-175.

Martin, S. S. (2004). A sampling of activities used in special education teacher preparation coursework: Meeting the standards. In Proceedings of Society for Information Technology and Teacher Education International Conference 2004(1), 4930-4935. Norfolk, VA: AACE.

Mastropieri, M. A., & Scruggs, T. E. (1994). Text versus hands-on science curriculum: Implications for individuals with disabilities. Remedial and Special Education, 15, 72-85. doi:10.1177/074193259401500203

Monibi, M.,& Hayes, G. (2008). Mocotos: Mobile communications tools for children with special needs. Proceedings of the 7th international conference on Interaction design and children, 121- 124.

Morse, T. E., Schuster, J. W., & Sandknop, P. A. (1996). Grocery shopping skills for persons with moderate to profound intellectual disabilities: A review of the literature. Education and Treatment of Children, 19, 487-517. Retrieved from http://www.educationandtreatmentofchildren.net/ [Last accessed on January, 2015]

Morse, T. E., & Schuster, J. W. (2000). Teaching elementary students with moderate intellectual disabilities how to shop for groceries. Exceptional Children, 66, 273-288.

Nam, C. S., Bahn, S., & Lee, R. (2013). Acceptance of assistive technology by special education teachers: A structural equation model approach.

International Journal of Human-Computer Interaction, 29(5), 365-377. doi: 10.1080/ 10447318. 2012. 711990

Nielsen, J. & Mack, R. L. (1994). Usability inspection methods. Wiley, New York, NY, USA.

Nielsen, J. (1993) Usability engineering. Academic Press, Boston.

Odluyurt, S. (2013). Kaynaştırmaya Devam Eden Otistik Özellikler Gösteren Çocuklara Kurallı Oyun Öğretiminde Akranları Tarafından Doğrudan Model Olma ve Videoyla Model Olma Öğretiminin Etkilerinin Karşılaştırılması. Educational Sciences: Theory & Practice. 13(1), 523-540.

Öncül, N. (2015). Otizm spektrum bozukluğu olan çocuklara sembolik oyunlarin küçük grupla ögretiminde canli modelle ve video modelle ögretimin karsilastirilmasi. Abant İzzet Baysal University. Dissertation.

Özak, H. (2008). Zihinsel yetersizliği olan ögrencilere okuma becerilerinin ögretiminde bilgisayar aracılığıyla sunulan eş zamanlı ipucuyla öğretimin etkililiği. Abant İzzet Baysal University. Master Thesis.

OZTEK (2015). Özel eğitim öğrencilerine yönelik teknoloji ile zenginleştirilmiş öğrenme ortamları kullanarak temel ve bilişsel kavramların öğretimi ve etkililiğinin araştırılması. TUBİTAK Supported Project. Project No: SOBAG 111K394. http://oztek.metu.edu.tr/ [Last accessed on January, 2015]

Parmar, R. S., & Cawley, J. F. (1991). Challenging the routines and passivity that characterize arithmetic instruction for children with mild handicaps. Remedial and Special Education, 12(5), 23–32, 43. doi:10.1177/074193259101200505

Pekkala, S. (2012). Usability evaluation of design solutions for tablet magazines. (Unpublished Master of Science in Technology). Department of Media Technology, Aalto University School of Science,

Pennington, R. C., Ault, M.J. & Sanders, A. (2010). Using simultaneous prompting and computer assisted instruction to teach story writing to students with autism. Assistive Technology Outcomes and Benefits Focused Issiue: Assistive Technology and Writing, (7)1, 24-35.

Ploog, B., Scharf, A., Nelson, D., & Brooks, P. (2013). Use of computer-assisted technologies (CAT) to enhance social, communicative, and language development in children with autism spectrum disorders. Journal of Autism and Developmental Disorders, 43(2), 301-322. doi:10.1007/s10803-012-1571-3

Riffe, D., Lacy, S. & Fico, F.G. (2005). Analyzing media messages: Using quantitative content analysis in research. Mahwah, NJ: Lawrence Erlbaum Associates.

Roberts, C., & Zubrick, S. (1992). Factors influencing the social status of children with mild academic disabilities in regular classrooms. Exceptional Children, 59, 192-202. Retrieved from http://sped.org/ [Last accessed on January, 2015]

Saffer, D. (2009). Designing Gestural Interfaces. O'Reilly Media, Sebastopol, CA.

Seo ,Y. & Bryant, D. P. (2009) Analysis of studies of the effects of computer-assisted instruction on the mathematics performance of students with learning disabilities, Computers & Education, 53 (3), 913-928.

Seo, Y & Woo, H. (2010). The identification, implementation, and evaluation of critical user interface design features of computer-assisted instruction programs in mathematics for students with learning disabilities. Journal of Computers & Education. 55 (1), 363-377

Seshadri, S. (2012). iPad gives voice to kids with Autism. Online special report retrieved from http://edition.cnn.com/2012/05/14/tech/gaming-gadgets/ipadautism /index.html [Last accessed on January, 2015]

Sevilla, J., Herrera, G., Martinez, B. & Alcantud, F.(2007) 'Web accessibility for individuals withcognitive deficits: a comparative study between anexisting commercial web and its cognitively accessibleequivalent.'ACM Transactions on Computer-HumanInteraction, 14 (3), pp. 1–23.

Shonkoff, J. P. & Phillips, D. A. (Eds.). (2000). From neurons to neighborhoods: The science of early childhood development. Washington, DC: National Academies Press. Retrieved from http://site.ebrary.com/lib/uiowa/docDetail.action?docID =10038720 [Last accessed on January, 2015]

Sidman, M. (1960). Tactics of Scientific Research: Evaluating Experimental Data in Psychology.

Spitz, H.H. (1979). Beyond field theory in the study of mental deficiency. In N.R. Ellis (Ed.), Handbook of mental deficiency: Psychological theory and research (2nd ed.).Hillsdale, NJ: Erlbaum

Sternberg, R. J. (2003). Cognitive Psychology (3rd ed.). Florence, KY:Wadsworth.

Stromer, R., Kimball, J. W., Kinney, E. M., & Taylor, B. A. (2006). Activity schedule, computer technology, and teaching children with autism spectrum disorder. Focus on Autism and Other Developmental Disabilities, 21, 14–24.

Tanju, E. H. (2004). 4-5 yaş grubu zihinsel engelli çocuklara şekil, renk ve sayı kavramlarının kazandırılmasında bilgisayar destekli eğitimin etkisinin incelenmesi. Hacettepe University. Dissertation.

Tawney, J. W., & Gast, D. L. (1984). Single subject research design in special education. Columbus, OH: Merrill.

Tekin, E. (2000). Tek-denekli araştırma yöntemleri ders notları. Eskişehir Anadolu University.

Tekin, E., ve Kırcaali İftar, G. (2001). Özel eğitimde yanlışsız öğretim yöntemleri. (1. Basım). Ankara: Nobel Yayın Dağıtım.

Tentori, M.,& Hayes, G. R. (2010). Designing for interaction immediacy to enhance social skills of children with autism. Proceedings of the 12th ACM International Conference on Ubiquitous Computing, Copenhagen, Denmark. 51-60. doi:10.1145/1864349.1864359

Tezcan, C. & Uçar, Ö. (2012) Zihinsel Engelli Çocuklara Web Destekli Uzaktan Eğitim Sistemi Kurulması: Matematik Dersi Uygulaması. http://dspace.trakya.edu.tr: 8080/jspui/handle/1/1441 [Last accessed on January, 2015]

Tezer, M. & Kanbul, S. (2009). Opinions of teachers about computer aided mathematics education who work at special education centers. World Conference on Educational Sciences.

Thompson, J., McGrew, K., & Bruininks, R. (1999). Adaptive and maladaptive behavior. Functional and structural characteristics. In R. L. Schalock & D Braddock (Eds.), Adaptive behavior and its measurement: Implications for the field of mental retardation (pp. 15-42). Washington, DC. American Association on Mental Retardation.

Turkey Istatistic Institution (2002). Özürlülük Oranı. Offical Website. from http://www.tuik.gov.tr/PreTablo.do?alt_id=1017 [Last accessed on January, 2015]

Uçar, Ö. (2007). Engelli çocuklar için yapay zeka tabanlı eğitim-destek araçları geliştirilmesi. Trakya University. Dissertation.

Upadhyay, N. (2006). M-Learning- a new paradigm in education. International Journal of Instructional Technology and Distance Learning, 3(2), 31–34. VTech.http://www.vtech.com/ [Last accessed on January, 2015]

Uzun, F. D., Gülen, Ş. B., Uzun, C., Çakır, H., Çağıltay, K., Karasu, N., & Kaplan Akıllı, G. (2013). The Potential of Using Kinect Technology Controlled With Body Movements in Education of Students having Mentally Disabilities.

Van Der Meer, L., Didden, R., Sutherland, D., O'Reilly, M.F., Lancioni, G.E. & Sigafoos, J. (2012). Comparing three augmentative and alternative communication modes for children with developmental disabilities. Journal of Developmental and Physical Disabilities. http://dx.doi.org/10.1007/s10882-012-9283-3

Van Der Meer, L., Kagohara, D.M., Achmadi, D., O'Reilly, M.F., Lancioni, G.E. & Sutherland, D. (2012). Speech-generating devices versus manual signing for children with developmental disabilities. Research in Developmental Disabilities, 33, pp. 1658–1669

Van Der Meer, L., Kagohara, D. M., Achmadi, D., Green, V. A., O'Reilly, M. F. & Lancioni, G. E. (2011). Teaching functional use of an iPod-based speech-generating device to individuals with developmental disabilities. Journal of Special Education Technology, 26, pp. 1–11.

Van Houten, R. (1979). Social validation: The evolution of standards of competency for target behaviors. Journal of AppliedBehavior Analysis, 12, 581-591.

Van Laarhoven,T., Johnson, J.W., van Laarhoven-Myers,T., Grider, K.L. & Grider, K.M. (2009). The effectiveness of using a video iPod as a prompting device in employment settings. Journal of Behavioral Education,18, 119–141.

Weber, R. P. (1990). Basic Content Analysis, 2nd ed. Newbury Park, CA.

William, P. & Hennig, C. (2014). Effect of web page menu orientation on retrieving information by people with learning disabilities. Journal of the Association for Information Science and Technology, 66 (4).

William, P. & Nicholas, D. (2006). Testing the usability of information technology applications with learners with special educational needs (SEN). Journal of Research in Special Educational Needs, 6 (1), 31–41.

Wheeler, J., Ford, A., Nietupski, J., Loomis, R., & Brown, L. (1980). Teaching moderately and severely handicapped adolescents to shop in supermarkets

using pocket calculators. Education and Training of the Mentally Retarded, 15, 105-112.

Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. Journal of Applied Behavior Analysis, 11, 203-214.

Yee, H. S. S. (2012). Mobile technology for children with autism spectrum disorder: Major trends and issues. E-Learning, E-Management and E-Services (IS3e), 2012 IEEE Symposium On, 1-5. doi:10.1109/IS3e.2012.6414954

Yıldırım, A. & Şimşek, H. (2000) Sosyal Bilimlerde Nitel Araştırma Yöntemleri. (Second Edition). Seçkin Yayıncılık, Ankara.

APPENDIX A

THE PARENT PERMISSION FORM

Sayın Veli,

Çalışmayı yürüten Sabiha Yeni, Orta Doğu Teknik Üniversitesi, Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümünde doktora öğrencisi olarak çalışmaktadır. Bu doktora tez çalışması Orta Doğu Teknik Üniversitesi öğretim üyesi Prof. Dr. Kürşat Çağıltay danışmanlığında yürütülmektedir. Çalışmanın amacı özel eğitime ihtiyaç duyan bireylere günlük yaşam becerileri öğretiminde eğitsel tablet bilgisayar uygulamalarının etkisini araştırmaktır.

Çocuğunuz ile periyodik çalışmalar yürütülecektir. Çalışma çocuğunuz için psikolojik veya fiziksel bir risk taşımamaktadır. Çalışmaya katılım tamamen gönüllüdür, çalışma sürecinde istediğiniz zaman çocuğunuzun katılımını engelleyebilir ve çalışmayı bırakabilirsiniz. Çalışma sırasında bilimsel değerlendirme amaçlı görüntü kaydı alınacaktır. Çalışmada gizlilik esas olacak, çocuğunuzun ismi hiçbir yerde rapor edilmeyecektir. Sabiha Yeni çalışma süresince kendisine soracağınız tüm sorulara cevap verecektir.

Çalışmaya ya da çocuğunuzun katılımına yönelik daha fazla bilgi için başvurulacak kişi Sabiha Yeni'dir. Telefon: 0530 5663450 E-posta Adresi: sabihaakgun@hotmail.com

İlginiz için teşekkürler,

Sabiha YENİ

Yukarıda açıklamasını okuduğum çalışmaya, oğlumun / kızımın katılımına izin veriyorum. Velinin:

Kodu: _____ İmzası: _____ Tarih: _____

İmzalanan bu formu lütfen öğretmeniniz aracılığı ile bize ulaştırın.

APPENDIX B

THE DEMOGRAPHIC INFORMATION FORM

Öğrenci Kodu:		Veli Kodu:	
Öğretmen Kodu:			
Yaş:			
Okula Devam Süresi:			
Yetersizlik Türü:			
Yetersizlik Düzeyi (Özür oranı):			
IQ seviyesi:			
Ek engel durumu var mı?			
Annenin Yaşı:		Babanın Yaşı:	
Annenin Eğitim Durumu:		Babanın Eğitim Durumu:	
Annenin Mesleği:		Babanın Mesleği:	
Kardeş Sayısı:			
Kardeşlerin Yaşları:			
Ailenin Gelir Düzeyi:			
RAM'ne geldiği günler/saatler:			
Farklı bir yerden eğitim alıyor mu? Alıyorsa kurum adı ve sınıfı nedir?			

Önkoşul beceriler	Yapabiliyor	Yapamıyor
Basit sözel yönergeleri takip edebilme (3-5 kelimelik sözel yönergeleri yerine getirir)	☐	☐

Dikkatini en az 10 dakika süre ile bir etkinliğe yöneltebilme	☐	☐
Motor becerileri taklit edebilme	☐	☐
Ellerini ve parmaklarını kullanabilme	☐	☐
Sorulan soruya işaret ederek ya da sözlü olarak tepki verebilme	☐	☐
Okula düzenli devam etme	☐	☐
Öğretilmesi planlanan beceriyi yapamama	☐	☐
Not:		

APPENDIX C

THE REINFORCEMENT FORM

Öğrencinin Kodu:……..

Öğretmenin Kodu:……..

Öğrenci için tercih ettiğiniz pekiştireçleri işaretleyiniz.

(…..) Kraker

(…..) Kek

(…..) Şeker

(…..) Kutu süt

(…..) Bisküvi

(…..) Meyve Suyu

(…..) Çikolata

(…..) Cips

(…..) Sakız

(…..) Meyve

(…..) Meyveli Yoğurt

(…..) Oyuncak ile Oynama

Diğer……..

APPENDIX D

PROBE, FOLLOW-UP AND GENERALIZATION SESSIONS DATA COLLECTION FORM

Değerli Uzman,

Halı süpürebilmek için gerekli olan becerileri verilmiş olan kriterlere göre değerlendirmeniz beklenmektedir (Doğru, Yanlış, Tepkide Bulunmuyor).

Öğrencinin Kodu:…….	Oturum Sayısı:…….
Öğretmenin Kodu:……	Başlangıç Zamanı:……..
Tarih:…….	Bitiş Zamanı:…….

Halı Süpürme				
Sıra no	Hedef Davranış	Doğru	Yanlış	Tepkide Bulunmuyor
1	Odadaki prizi gösterir.			
2	Fiş kablosunu çekerek yuvadan çıkarabilir.			
3	Fişi prize takabilir.			
4	Açma düğmesine basabilir.			
5	Hortumu tutma yerinden tutabilir.			
6	Hortumu ileri geri hareket ettirerek süpürebilir.			
7	Kapatma düğmesine basabilir.			
8	Fişi prizden çekebilir.			

9	Fişi sarma düğmesine basarak fişi yuvaya toplayabilir.			
10	Elektrikli süpürgeyi kendi yerine koyabilir.			
	Toplam			

APPENDIX E

INTERVIEW PROTOCOL FOR THE SPECIAL EDUCATION TEACHERS

Görüşülen Kişi(ler) : ……

Görüşmeyi Yapan : ……

Tarih & Saat : …..…/…..…/ 2015 & ...… : …...

Görüşme Süresi : …….....

Görüşmenin Yapıldığı yer : …….....

Merhaba,

Bu çalışmanın amacı eğitsel amaçlı tablet bilgisayar uygulamalarının zihinsel engelli öğrencilerin günlük yaşam becerileri kazanmalarındaki etkililiğini ortaya koymaktır. Öncelikle görüşlerinizi benimle paylaşmayı kabul ettiğiniz için teşekkür ediyorum. Bu konudaki düşünceleriniz ve görüşleriniz çalışma için büyük önem taşımaktadır. Başlamadan önce bazı noktaları vurgulamak istiyorum. Yapacağımız görüşme sadece araştırma amaçlı kullanılacaktır. Bu çalışma sonucunda oluşturulacak dokümanlarda isminiz doğrudan ya da dolaylı olarak kullanılmayacaktır. Araştırma tamamlandıktan sonra ilgili analiz, sonuç ve tavsiyelerimizi eğer isterseniz sizlerle paylaşabiliriz. İzin verirseniz görüşmeyi kaydetmek istiyorum. Sizce sakıncası var mı? Sormak istediğiniz bir soru var mı?

Uygulamalar ile ilgili sorular:

1. Tablet bilgisayar uygulamalarını öğreticilik ve etkililik açısından nasıl değerlendiriyorsunuz? Yeni beceriler öğretmede tablet bilgisayar uygulamalarının işe yarayacağını düşünüyor musunuz?
2. Tablet bilgisayar uygulamalarının özel eğitim öğrencileri için faydalı olduğunu düşünüyor musunuz?
3. Tablet bilgisayar uygulamalarını kullanırken siz ve öğrencileriniz eğlendiniz mi?
4. Tablet bilgisayar uygulamalarını kullanmak siz ve öğrencileriniz için ne kadar kolay?
5. Tablet bilgisayar uygulamalarını gelecekte öğretim etkinliklerinizde kullanmak ister misiniz?
6. Kullandığınız tablet bilgisayar uygulamalarının sizce faydalı yönleri var mıdır? Varsa nelerdir?
7. Tablet bilgisayar uygulamalarında sizin hoşlanmadığınız yönler var mıydı? Varsa nelerdir?

Tablet bilgisayar ile ilgili sorular:

1. Tablet bilgisayarları öğretim etkinliklerinizde daha önce kullandınız mı?
2. Tablet bilgisayarları gelecekte öğretim etkinliklerinizde kullanmak ister misiniz?
3. Tablet bilgisayar kullanmada kendinizi ne derece yeterli hissediyorsunuz?
4. Sizce tablet bilgisayarların eğitimde kullanımı zor ve karmaşık mı?
5. Kurumunuz tablet bilgisayarların öğretim etkinliklerinde kullanılmasını teşvik ediyor mu?

APPENDIX F

OBSERVER NOTIFICATION SHEET

Sevgili gözlemci: Bu bilgi formu, gözlemciler arası güvenirlik ve uygulama güvenirliği verilerini toplayacak olan gözlemciye ışık tutması amacıyla düzenlenmiştir. Bu amaçla, gözlemciye, araştırmada yürütülen uygulamalar hakkında bilgi sunulmuştur.

1- Bu araştırmanın amaçları nelerdir?

Bu araştırmada aşağıdaki sorulara yanıt aranmaktadır: (1) Tablet bilgisayar aracılığıyla sunulan uygulamaların, zihinsel engelli bireylere günlük yaşam becerilerinin öğretilmesinde etkili midir? (2) Zihinsel engelli üç öğrenciye, günlük yaşam becerisi tablet bilgisayar aracılığıyla sunulan uygulama ile öğretilebilirse, bu becerinin kalıcılığı öğretim bittikten bir, üç ve dört hafta sonra korunabilir mi? (3) Tablet bilgisayar aracılığıyla sunulan uygulama ile zihinsel engelli bireylere günlük yaşam becerisi öğretilebilirse, bu becerinin genellenmesi farklı araçlarda sağlanabilir mi? Amaçta ifade edilen, deneklerin beceriyi öğrenmiş olması beceri basamaklarını yanlışsız tamamlamasını (%100) gerektirir.

2- Uygulamacı oturumlarda deneklerin dikkatini çalışmaya yöneltmek için hangi tür dikkati sağlayıcı ipucu sunmuştur?

Uygulamacı, araştırma süresince, deneklere "Ekrana bak", "Çalışmaya hazır mısın?" biçiminde kişisel dikkati sağlayıcı ipucu sunmuştur.

3- Uygulamada deneklere sunulan hedef uyaran nedir?

Araştırma süresince, deneklerle gerçekleştirilen baseline, yoklama, öğretim, izleme ve genelleme oturumlarında hedef uyaran olarak “Elektrik süpürgesi ile halıyı süpür” denilmiştir.

4- Öğretim oturumlarında kullanılan kontrol edici ipucu nedir?

Uygulamada tablet bilgisayar aracılığı ile gerçekleştirilen öğretim oturumlarında deneklere "sözel ipucu + model ipucu" birlikte sunulmuştur. Tablet bilgisayarda görüntüyü izlerken, sözel ipucu olarak örn: "Bu açma düğmesidir" sesinin verilmesiyle birlikte tablet bilgisayar ekranındaki sunuda yer alan “açma düğmesi” resmi gösterilerek model ipucu sunulmuştur.

5- Araştırmada kullanılan yanıt aralığı nedir?

Araştırmanın yoklama, öğretim, genelleme ve izleme oturumlarının tümünde yanıt aralığı 4 sn olarak kullanılmıştır.

6- Deneklerin doğru ve yanlış tepkilerine hangi davranış sonrası uyaranlar sunulmaktadır?

Uygulamada, deneklerin doğru ve yanlış tepkilerine karşılık;

Baseline, yoklama, izleme ve genelleme oturumlarında deneklerin göstermiş olduğu her doğru tepki, sözlü ifadelerle (Örn.: “Bravo doğru gösterdin”. gibi) sürekli pekiştirme tarifesiyle ve oturum tamamlandıktan sonra rastgele pekiştirme tarifesiyle yiyecek yada oyuncak pekiştireci ile pekiştirilmiştir. Deneklerin yanlış tepkilerinde ise çalışma sonlandırılmıştır. Denek tepki vermediği durumda hedef uyaran (ana yönerge) tekrar sunulmuş, yanlış tepki verdiğinde ya da tekrar tepki vermediği durumda çalışma sonlandırılmıştır. Oturumlar esnasında doğru ve yanlış gerçekleştirdiği basamaklar araştırmacı tarafından kayıt edilmiştir.

Öğretim oturumlarında ise deneklerin göstermiş olduğu her doğru tepki, araştırmacı tarafından sözlü ifadelerle (Örn.: “Bravo, Aferin” gibi) sürekli pekiştirme tarifesiyle ve oturum tamamlandıktan sonra yiyecek veya oyuncak pekiştireci ile

pekiştirilmiştir. Yanlış tepkilerinde ise, hata düzeltmesi olarak "yanlış yaptığı" ifade edilmiş ve "görüntünün tekrar izlenmesi gerektiği" söylenmiş. Öğrenci önceki konumuna geri getirilerek, tablet bilgisayardan görüntü tekrar izletilmiştir. İzledikten sonra hedef uyaran tekrar verilmiştir. Öğrenciden tüm basamakları kesintisiz olarak doğru yapıncaya kadar bu süreç tekrarlanmıştır.

7- Araştırmada kullanılan denemeler arası süre nedir?

Araştırmanın öğretim oturumlarında denemeler arası süre 4 sn olarak belirlenmiştir.

8- Genelleme oturumları nasıl gerçekleştirilmiştir?

Bu araştırmada genelleme oturumları, önceki oturumlarda kullanılan elektrikli süpürgeden farklı bir süpürge ve farklı bir halı kullanılarak gerçekleştirilmiştir.

APPENDIX G

PROBE, FOLLOW-UP AND GENERALIZATION SESSIONS

PROCEDURAL FIDELITY CHECKLIST

Amaç: Bu formun amacı, uygulamacının uygulamış olduğu yoklama oturumlarını hazırlanmış olduğu planlarına ne ölçüde uygunluk gösterdiğini belirlemektir.

Kullanma yönergesi: Bu formda, uygulayıcının gerçekleştirmesi beklenen beceri basamakları "Beceri basamakları" sütununda yer almaktadır. Gözlemci, uygulamacının bu basamakları yerine getirip getirmediğini kamera kayından izleyerek, uygunsa "Evet" sütununa; uygun değilse " Hayır" sütununa işaret koymak suretiyle belirleyecektir.

Öğrencinin Kodu :	Gözlemcinin Kodu:
Uygulamacının Kodu:	Tarih :
Oturum No:	Toplam Süre:

SN	Beceri Basamakları	Evet	Hayır
1	Ortamı dikkat dağıtıcı uyaranlardan arındırır		
2	Araç-gereci kontrol eder		
3	Dikkat işaretini verir		
4	Ana Yönergeyi verir		
5	Öğrenci, ana yönerge verildikten sonra beceri basamaklarını		

	bağımsız olarak yaparsa,		
6	Sözlü olarak pekiştireç verir (Aferin, Bravo vs.)		
7	Bağımsız olarak gerçekleştirdiği beceri basamaklarını ölçü aracında işaretler.		
8	Öğrenci, ana yönerge verildikten sonra yanlış tepkiye yönelirse,		
9	Çalışmayı sonlandırır		
10	Öğrenci, ana yönerge verildikten sonra hiç tepkide bulunmazsa		
11	Ana yönergeyi tekrar eder.		
12	Öğrenciden yine tepki gelmezse uygulamayı sonlandırır.		

APPENDIX H

INTERVENTION SESSIONS PROCEDURAL FIDELITY CHECKLIST

Amaç: Bu formun amacı, uygulamacının uygulamış olduğu "öğretim oturumlarını" hazırlanmış olan öğretim planlarına ne ölçüde uygunluk gösterdiğini belirlemektir.

Kullanma yönergesi: Bu formda, uygulayıcının gerçekleştirmesi beklenen beceri basamakları "Beceri basamakları" sütununda yer almaktadır. Gözlemci, uygulamacının bu basamakları yerine getirip getirmediğini kamera kayından izleyerek, uygunsa "Evet" sütununa; uygun değilse " Hayır" sütununa işaret koyarak belirleyecektir.

Öğrencinin Kodu :	Gözlemcinin Kodu:
Uygulamacının Kodu:	Tarih :
Oturum :	Toplam Süre:

SN	Beceri Basamakları	Evet	Hayır
1	Ortamı dikkat dağıtıcı uyaranlardan arındırır		
2	Araç-gereci kontrol eder		
3	Çalışılacak olan konuyu söyler.		
4	Dikkat işaretini verir		
5	Becerinin her bir basamağı ile ilgili görüntüyü adım adım sunar		
6	Öğrencinin görüntüyü izleme esnasında dikkati dağılırsa, dikkati çeker.		

7	Her basamak için uygun yönergeyi verir		
8	Yanıt aralığını bekler		
9	Öğrenci doğru tepki verirse;		
10	Öğrenci, doğru tepki verdiğinde sözlü olarak pekiştirir.		
11	Öğrencinin vermiş olduğu doğru tepkileri ilerleme kayıt çizelgesinde ilgili bölüme kaydeder.		
12	Öğrenci yanlış tepki verirse,		
13	Hata düzeltmesi olarak "yanlış yaptığı" ifade edilmiş		
14	Öğrenciyi bir önceki pozisyonuna getirir.		
15	Becerinin ilgili basamağı ile ilgili görüntüyü birkez daha sunar.		
16	İlgili yönergeyi tekrar verir.		
17	Yanıt aralığını bekler.		
18	Öğrenci tepkisiz kalırsa,		
19	Öğrenci tepkisiz kaldığında öğrenciyi bir önceki pozisyonuna getirir		
20	Becerinin ilgili basamağı ile ilgili görüntüyü birkez daha sunar.		
21	İlgili yönergeyi tekrar verir		
22	Yanıt aralığını bekler		
23	Becerinin tüm basamaklarını doğru şekilde yapana kadar öğrencinin vermiş olduğu tepkilere uygun şekilde yazılı basamakları uygular.		

APPENDIX I

SATISFACTION SURVEY FOR SPECIAL EDUCATION TEACHERS

"Elektrikli Süpürge ile Halı süpürme" (EHS) tablet bilgisayar uygulamasını göz önünde bulundurarak aşağıda ki anketi size göre en uygun olandan (Kesinlikle Katılıyorum) en az uygun olana doğru (Kesinlikle Katılmıyorum) işaretleme yapmanız beklenmektedir. Samimi ve içten cevaplarınız için teşekkür ederim.

Sabiha YENİ

Öğretmen Kodu:..... Yaş:.....

Branş:..... Mesleki Deneyim (Yıl):.....

İfadeler	**Kesinlikle Katılıyorum**	**Katılıyorum**	**Kararsızım**	**Katılmıyorum**	**Kesinlikle Katılmıyorum**
Öğrencim EHS uygulamasını sevdi					
EHS Uygulaması öğrencimin ilgisini çekti					
EHS Uygulaması öğrencim için faydalıydı					
Öğrencim uygulamayı tekrar kullanmak istedi					
EHS Uygulamasını anlamak öğrencimin çok vaktini aldı					
EHS Uygulaması sıkıcı olduğu için öğrencim uygulamayı tamamlamadı					
EHS Uygulamasının bilgi düzeyi öğrencim için çok zorlayıcıydı					
EHS Uygulamasının bilgi düzeyi öğrencim için çok kolaydı					
Öğrencim daha once öğrendiklerini EHS uygulaması ile geliştirdi					
Öğrencim bu uygulama ile bilgisayar becerilerini geliştirdi					
Öğrencim EHS uygulaması ile hoş vakit geçirdi					
EHS uygulamasının benzerlerinden hazırlanmasını isterim					
Sınıfta ve evde çok rahat kullanılabilir					
Diğer öğretmenlere ve ailelere de öneririm					
EHS Uygulamasının bilgi organizasyonu karışık değil					
EHS Uygulaması kolay kontrol edilebilir					
EHS Uygulamasının kullanımını öğrenmek kolay					
EHS Uygulamasının görsel tasarımı öğrenciler için uygun					
EHS Uygulamasındaki basamaklar öğrenciler tarafından kolay anlaşılabilir					
Yorum ve Önerileriniz:					

APPENDIX J

OFFICIAL PERMISSION FROM METU

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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Gönderilen : Prof. Dr. Kürşat ÇAĞILTAY
Bilgisayar ve Öğretim Teknolojileri Eğitimi

Gönderen : Prof. Dr. Canan Özgen
IAK Başkanı

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü öğrencisi Sabiha Yeni'nin "Examining the Effectiveness of Educational Tablet PC Applications to Teach Daily Living Skills to Students with Intellectual Disabilities - Zihinsel Engelli Öğrencilere Günlük Yaşam Becerilerinin Öğretiminde Eğitsel Tablet Bilgisayar Uygulamalarının Etkililiğinin İncelenmesi" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

17/10/2014

Prof.Dr. Canan Özgen
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APPENDIX K

TEACHERS' VIEWS ABOUT EDUCATIONAL USAGE OF TABLETS (TURKISH)

Tema	Alt-tema	Öğretmenlerin ifadeleri
Deneyim	***Eğitsel amaçlı tablet kullanımı ile ilgili deneyimlerim....***	
	Cep telefonu (dokunmatik ekranlı)	"Bazen tablet bilgisayar değilde dokunmatik ekranlı telefonlarımızı kullanıyoruz. Basit toplama -çıkarma oyunlarını veya okuma çalışırken kullanıyoruz." "Bazı aktivitelerde cep telefonumu kullanıyorum mesela eğitsel oyunlar ve boyama yaparken." "Mesela telefonumuza meyve resimleri indiriyorduk. Ya da işte onu slayta çevirmeye çalışıyorduk, o da bizim için bayağ vakit alıyordu. Böyle hazır programlanmış uygulamalar bizim daha çok işimize yarar tabi.""
	Bilgisayar	"Tablet yerine sayıları renkleri öğretmede boyama yapma amaçlı bilgisayarları kullandık."
	Tablet deneyimi yok	"Daha önce hiç tablet kullanmamıştım."
Tutum	***Derslerimde tablet kullanmayı isterim/ istemem, çünkü...***	
	Dikkat çekme, dikkati uzun süre sabit tutma	"Tablet isterim, çünkü çocukların dikkati artıyor ve dikkatini daha uzun süre sabit tutabiliyorlar. Normalde özel eğitim öğrencilerini 10 dk sınıfta tutmak zor olabiliyorken, tablet gibi cihazlarla çok daha uzun süre çalışılabiliyor." "Büyük ekranlı tabletler bizim öğrencilerimiz için etkileyici oluyor. Oyüzden biraz daha büyük ekranlı, televizyon ekranına yakın büyüklükte birşey olsa çok daha iyi olur. öğrenci çok daha rahat görebilir."

	Zaten cep telefonu kullanıyorum	"Tablet kullanmak isterim ama telefon zaten kullanıyorum."
	Keşke her sınıfta tablet olsa	"İleride çoğu şeyin tablette yapılacağını düşünüyorum. Halbuki aslında imkanımız olsa da her sınıfta birer tane tablet olsa ve o şekilde çalışılsa daha iyi olur."
Eğitim	***Eğitsel amaçlı tablet kullanımı ile ilgili eğitim almak isterim/ istemem, çünkü...***	
	Faydalı olabilir	Öğrencilere nasıl daha faydalı olabiliriz, bunun için bir tablet eğitimi olsa tabiki daha iyi olur."
	Öğretim etkinliklerim çeşitlenir	"Öğrencilerle yapacağım etkinlikleri çeşitlendirebilmek için tablet eğitimi almak isterim."
	Öğrencilerler uygulama fırsatım olmadı	"Materyal tasarımı diye bir ders almıştım üniversitede iken. benim dönemimde tepegöz, tablet eğitimi vs vardı ama bizim birebir öğrencilerle uygulama fırsatımız olmadı. Eğitim iyi olur."
	Tablet uygulamaları sayısı yetersiz	"Şuan bir eğitimimiz yok açıkçası, zaten hazırda özel eğitim için çok programda yok. Olsa zaten eğitim almak isteriz. Eğitimcilerin derslerini kolaylaştırıcı, iş yükünü azaltan bir araç, hem de öğrencilerimizi daha iyi bir öğrenme ortamı sağlayabiliriz."
Algılanan Kolaylık	***Derslerde tablet kullanımı kolaydır /zordur, çünkü ....***	
	Bireysel farklılıklardan ötürü, bazı öğrenci için zor, bazıları için kolay	"Özel eğitim alanında zorluk kolaylık her çocuğa göre değişen birşey maalesef. Her çocuk bireysel farklılıklara sahip. Ama okula giden çocuklar için mesela O.A. gibi kullanımı basit. Çoğu şeyi çok kolaylıkla öğrenebiliyor. tabletin onlar için faydalı olduğunu düşünüyorum." "Öğrenciye göre değişir ama dediğim gibi çocukların neredeyse tümü bunu kullanmaktan hoşlanıyor zaten."
	Birkaç basit alıştırma ile kolay adapte olunur	"Zor ve karmaşık değildi. daha önce bu aletle tanışmadıkları için biraz çekimser davrandılar ilk başta, alışma sürecinden sonra kolaylıkla kullandılar."
	Bilgisayar tabletten daha karmaşık	"Telefonuda tabletide masanın üzerine koyarak kullanabiliriz, bence gayet kullanışlı. Bilgisayar ile karşılaştırdığımızda tablet kullanımı çok daha kolay dokunmatik olduğu için, bilgisayarda tuşa basması gerekecek, fareyi oynatması gerekecek daha kompleks bir iş onun için." "Önceden, bilgisayarlar ile çalışıyorduk ama bilgisayarlar ile çalışmak tabletten daha zor."
	Odaklanmayı sağlar	"Tabletler öğrencileri yeni birşeyler öğrenmek için veya iletişim kurmak için zorlamıyor, tablet zaten onların dikkatini kendiliğinden çekiyor." "Özellikle tabletlerin dokunmatik olması özel eğitim öğrencilerinin daha çok dikkatini çekiyor."
Kurumsal Destek	***Çalıştığım kurum derslerde kullanmamız için tablet temin etmiyor, alternatif olarak/ çünkü....***	

Dokunmatik ekranlı kişisel cep telefonları	"Biz de şuanda yok ama biz dokunmatik telefonlarla bazı davranışları kazandırmaya çalışıyoruz. Mesela hayvan sesleri olsun, renk kavramında olsun az da olsa kullanıyoruz." "Bazen derslerde kendi telefonlarımızı kullanıyoruz. Telefonu dikkati toplamak için ya da bazen ödül olarak derslerde kullanıyorum."
Yetersiz sayıda tablet uygulaması	"Şu an yok. Çünkü piyasada özel eğitim öğrencilerine uygun kullanıma hazır fazla program yok. Alt yapı olsa bile program temin edemeyeceğiz."

APPENDIX L

TEACHERS' VIEWS ABOUT THE SCV TABLET APPLICATION (TURKISH)

Tema	Alt-tema	Öğretmenlerin İfadeleri
Öğreticilik/Etkililik	***SCV tablet uygulaması öğretici/ öğretici değil çünkü.....***	
	Görsel/işitsel içerik sunuluyor	"Görsel olması, görselin onların düzeyinde olması bence gayet öğretici. Beceri öğretmede işe yarayacağını düşünüyorum." " Bu uygulama çizgi film gibi çocuğun hem gözüne hem kulağına hitap ettiği için çocukların ilgisini çekiyor." "Tablette gördüğü bilgiler görsel olduğu için bizim konuşarak verdiğimiz bilgilerden ya da talimatlardan çok daha etkili oluyor." "Görsel olduğu için faydalı olduğunu düşünüyorum."
	Uygulama temelli	"Yaparak- yaşayarak öğrenmek zaten çok daha mantıklı ve işlevsel, öğretici bir yöntem olduğunu düşünüyorum."
	Günlük beceri eğitimi sunuluyor	"Çocuklar için günlük becerilerin öğretiminde yararlı oldu."
	Gerçek malzemeler kullanılıyor	"Birebir pratik yaparak, gerçek yaşamdan bir malzemenin kullanılması çok etkili oluyor."
	Özellikle bayan öğrenciler için ideal	"Özellikle bayanlar için etkili oldu.
Faydalılık	***SCV tablet uygulaması faydalı / faydalı değil çünkü...***	
	Teknoloji kullanım becerisini arttırır	"Teknolojik araç gereçleri kullanmada da beceri kazanıyorlar"
	Dikkati arttırır	"Dikkat becerilerini de geliştirdiğini düşünüyorum." "Ayrıca tabletler telefonlar zaten çocukların dikkatini

		çekiyor."
	Motor becerileri geliştirir	"Uygulama imkanı sunduğu için öğrencilerin motor becerilerini geliştirmeleri açısından faydalı buldum." "Yaparak yaşayarak öğrenmenin öğrencilere faydası olacaktır."
	Özgüveni destekler	"Öğrenci öğrendikçe o görevi bağımsız yapabilecektir, bu da özgüvenini arttırır." "Evde kimse onlara birşey süpürtmemiştir çünkü hem yeterli bulmuyorlar kapasitelerini hem güvenmiyorlar ama burada yaptırıldığı için onların hoşuna gitti. Biz de yeterli biriyiz ki bize süpürtme yaptırılıyor diye düşündüler, özgüvenleri arttı."
	Öğretmene zaman kazandırır	"Bazı öğrenciler için derste zaman kazanma açısından da faydalıdır."
	Veliler günlük beceri eğitimi ile ilgili istekli	"Veliler, özbakım becerileri öğretilmesini istiyor." "Veliler de zaten çocukları için bu becerileri kazandırmak istiyorlar."
	Transfer/genellemeye yardımcı olur	"Bizim öğrencilerimizin en büyük sorunu transfer ve genelleme. Birşeyleri öğreniyorlar ama tüm eşyalara genelleyemiyorlar. Tablet bilgisayarda aynı materyalin farklı çeşitlerini gösterme imkanı sağlıyor."
Eğlence	***SCV tablet uygulaması eğlencelidir/ eğlenceli değildir, çünkü...***	
	Farklı bir yöntem	"Eğlendiler kesinlikle. özellikle O.A. çok mutlu oldu. Siz gelmediğiniz zaman bile sizi sordu. Alışık olduklarından farklı bir yöntemdi, öğretmen eşliğinde kurcaladı uğraştı, zihnini meşgul etti."
	Dikkat çekici	"Konsantrasyonunu arttırdı." "Dikkatlerini çekti"
	Merak duygusunu arttırdı	"Merak duygusu oluştu."
	Bağımsız iş yapabilmekten mutlu oldular	"Öğrencilerin hoşuna gitti bayağ, bağımsız bir şekilde birilerinin ona iş yaptırması özgüvenlerini arttırdı açıkçası. Gözlerindeki o heyecanı, mutluluğu gözlemledik çocukların. Bağımsız şekilde bir iş yapmak çocukların çok hoşuna gitti. Çünkü orada annesinden, ablasından bir farkı kalmadı, herkesin yapabildiği bir işi onlarda yapabildi"
Kolaylık	***SCV tablet uygulaması kolaydır/ kolay değildir, çünkü...***	
	Uygulamayı öğrenmek kolay	"Özellikle O.A. bir ara kendi durdurup uygulamayı kullanmaya başlamıştı." "Tablet bilgisayarı ve

		uygulamayı kullanmak kolay, hatta öğrenci uygulamayı kendi durdurup kendi başlatıyordu."
	Önkoşul davranışları sağlayan çocuklar için uygun	"Zorluk derecesi önkoşul davranışları sağlayan öğrenciler için uygundu."
	İzlemek ve ardından uygulamak kolay	"Öğrenciler için hem görsel olarak izlemek hem de uygulamak kolaydı."
	Fazla vakit almadı	"Uygulamayı öğrenmek fazla vakit almadı."
	Halı üzerindeki eşyaları kaldırmak zordu (pilot çalışmada)	"Pilot çalışmada halının üzerindeki eşyaları kaldırmak vs. bunlar biraz sıkıntılı olmuştu, birebir aynı materyal olmadığı için algılamakta zorlandı."
Tutum (gelecekte kullanmak)	***SCV tablet uygulmasını gelecekte kullanmak isterim / istemem, çünkü...***	
	Eğlenceli, faydalı, ilgi çekici	"Böyle uygulamaları kullanmak isteriz hem öğrenciler için çok eğlenceli, onların ilgisini çekiyor, hem de onlar için faydalı."
	Hızlı bilgi aktarımı	"Bazı şeyler vardır tablet ile daha hızlı kazandırılabilir veya ona göz aşinalığı sağlamak için kullanılabilir. Ayrıca becerinin bütününü hızlı bir şekilde gösterebilirim."
	Görsel ve işitsel destek	"Görsel hafızasını desteklemek için kullanabilirim." "Görüntü merkezli bir eğitim ve işitsel olması onlar için çok daha kolaylaştırıcı oluyor."
	Öğretmene zaman kazandırma	"Bir öğretmenin sürekli bir süpürgeyi anlatması ya da bir süpürge resmi göstermesi ile o işin yapılırken tabletten görüntülerinin izlenmesi birbirinden çok farklı. Açıkçası tablet daha çok zaman kazandırıyor aslında."
Kötü yön	***SCV tablet uygulamasında kötü yada değişmesi gerektiğini düşündüğüm şeyler...***	
	Tek tek parça isimlerinin öğretilmesi (pilot çalışmada)	"DS (pilottaki öğrenci) için tek tek parçaların öğretilmesinin ve isimlerinin söylenmesinin doğru olmadığını düşünüyordum. zaten o zamanda söylemiştim, çünkü onlar için tek tek parça öğrenmek çok zor. ama bir bütün olarak yaptırmak daha mantıklı. Zaten esas çalışmada o kısımları çıkartmıştınız."
	Halı üzerindeki eşyaları kaldırmak (pilot çalışmada)	"Halının üzerindeki eşyaları kaldırma kısmı (pilot çalışmada) çıkartılmalı bence. Çünkü temel en ilkel hali ile süpürme işlemi öncelikle öğretilmelidir."
	Değişmesi gereken yer yok	"Bence güzel bir uygulama, değişmesi gereken bir yeri yok." "Hoş olmayan bir yön yoktu aslında. Velilerin

	çok hoşuna gitti, çocuklar da çok değişik bir öğretim ortamı bulmuş oldu"
Süpürürken sadece el görünmesi (beden görünebilirdi)	"Süpürme işlemi sırasında karakterin sadece kolları görünüyordu, bedeni yoktu. Hayali biri süpürüyor gibi görünüyordu, kişinin bedeninin tamamının görünmesi sağlanabilir."

APPENDIX M

EQUIPMENTS USED IN THE STUDY

Tablet

Exper EasyPad P10AN

Ekran büyüklüğü: 10.1 inç

Çoklu dokunmatik ekran

İşlemci: Nvidia Tegra 2 işlemci

İşletim Sistemi: Android 2.2

Pil ömrü: 7,5 saat

Ağırlık: 750 gram

Video Camera

Sony Digital HD Video Camera Recorder

Görüntü Boyutu: 1920x1080 Full HD 60p with 8.9MP

Optik Zoom: 27x

Dijital Zoom: 32x

Fil modu: 29.8 mm

Objektif: Carl Zeiss Vario Tessar Lens

LCD Boyut: 2.7 inç

APPENDIX N

PRACTICAL IMPLICATIONS FOR SPECIAL EDUCATION TEACHERS / PRACTITIONERS (TURKISH VERSION)

Elektrikli süpürge ile halı süpürme uygulamasını kullanırken uygulamacıların/ özel eğitim öğretmenlerinin takip etmesi gereken adımlar aşağıda sunulmuştur:

(1) Uygulama birtakım önkoşul becerileri sağlayan öğrenciler için uygundur. Ön koşul beceriler: (a) basit sözel yönergeleri takip edebilme (en az 5 kelimelik cümleler), (b) en az 10 dakika boyunca dikkatini bir olaya yöneltme, (c) motor becerileri taklit edebilme, (d) ellerini ve parmaklarını kullanabilme, (e) sözel olarak veya parmağıyla işaret ederek sorulan soruya cevap verebilme, (f) herhangi ek bir fiziksel sağlık probleminin olmaması

(2) Uygulamacı eğer dikkat dağıtıcı bir uyaran var ise ortamdan kaldırmalı.

(3) Uygulamacı, çalışılacak olan konuyu öğrenciye söylemeli.

(4) Uygulamacı uygulamayı izletmeye başlamadan once dikkat işaretini vermeil, dikkati uygulamaya çekmeli.

(5) Uygulamacı, becerinin her bir basamağı ile ilgili görüntüyü tabletten öğrenciye göstermeli. Öğretim oturumları için “adım adım” prensibi tavsiye edilmekte. Eğer öğrenci uygulamayı baştan sona kesintisiz olarak izlerse, uygulama esnasında becerinin ilk basamağını unutabilmektedir. Bu yüzden,

önerilen her bir adım ile ilgili görüntüyü tabletten izledikten sonra ilgili adımı uygulaması istenmelidir.

(6) Eğer uygulamayı izlerken dikkat dağılırsa, uygulamacı öğrencinin dikkatini derse çekmelidir.

(7) Uygulamacı,uygulamanın ilgili sahnesini izlettirdikten sonra her bir adım için ilgili yönergeyi vermelidir. Her bir adımı öğrencinin uygulaması istenmelidir.

(8) Uygulamacı yanıt aralığını beklemelidir, yanıt aralığı öğrenciye göre değişmekle birlikte yaklaşık 4 saniye olarak hesaplanabilir.

(9) Eğer öğrenci doğru yanıt verirse, uygulamacı sözlü olarak pekiştireç verebilir. Yanlış yanıt verirse, "Yanlış yaptın" diyerek hata düzeltmesi yapmalı ve öğrenciyi önceki konumuna geri getirmelidir. Buna ek olarak, aynı sahneyi öğrenciye tekrar izletmeli. Eğer öğrenci yanıt vermezse, uygulamacı öğrenciyi önceki pozisyonuna geri getirmeli ve aynı sahneyi tekrar izletmelidir.

Uygulamacı bu süreci tüm beceri basamakları için tekrarlamalı ve bitene kadar devam etmelidir. Araştırma bulgularına göre, ardışık üç öğretim oturumundan sonra bu uygulamayı kullanarak öğrencilerin elektrikli süpürge ile halı süpürme becerisini öğrenmiş olması beklenmektedir.

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name	: Yeni, Sabiha
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EDUCATION

Degree	Institution	Year of Graduation
PhD	METU, CEIT	2015
MS	Marmara University, CEIT	2011
BS	Marmara University, CEIT	2008
High School	Vefa Anatolian High School, İstanbul	2004

WORK EXPERIENCE

Year	Place	Enrollment
2011-Present	Yıldız Technical University, CEIT	Research Assistant
2013 June-September	Texas A&M University, USA	Visiting Scholar
2008-2011	Ministry of National Education	IT Teacher

RESEARCH PROJECTS

Title of Project	:Tablet bilgisayar erişimli asenkron video ders kayıtlarının teknoloji eğitiminde kullanılması:Avitab Projesi
Enrollment	: Researcher

Supporting Organization	: BAP
Start/End Date	: November 2012 / November 2014

Title of Project	:Temel Bilgi Teknolojisi Becerilerinin Kazandırılmasına Yönelik Geliştirilen Otomatik Değerlendirme ve Geri Bildirim Sistemi İle Verilecek Sosyal Paylaşım Temelli ve Bilgisayar Temelli Geri Bildirimin Öğrenme Performansına ve Öz-Yeterlilik Algısına Etkisi
Enrollment	:Researcher
Supporting Organization	:TUBITAK
Start/End Date	:April 2012 / March 2014

Title of Project	:Öğrenme Yönetim Sistemleri ve Mobil Tablet Araçlar Kullanılarak Klasik Düz Anlatım Yöntemi İle İşlenen Derslerin Etkinliğinin Arttırılması
Enrollment	:Researcher
Supporting Organization	:BAP
Start/End Date	:September 2011 / December 2012

SCHOLORSHIPS

2013-2015: The Scientific and Technological Research Council of Turkey (TÜBİTAK), National Doctoral Student Scholarship, 2211

2008-2011: The Scientific and Technological Research Council of Turkey (TÜBİTAK), National Master Student Scholarship, 2210.

PUBLICATIONS

Journals in the Scope of SCI / SCI-Expanded / SSCI / AHCI

Varank, Y., Yeni, S., & Gecu, Z. (2014). Effectiveness of Tablet PCs in the Classroom: A Turkish Case. Revista De Cercetare Si Interventie Sociala, 46, 22-36.

Varank, I., Adıgüzel, T., Erkoç, M. F., Köşkeroğlu-Büyükimdat, M., Aktaş, M., Cömert, Z., Yeni, S., & Esgin, E. (2014). Effectiveness of an online automated evaluation and feedback system in an introductory computer literacy course. Eurasia Journal of Mathematics, Science & Technology Education,10(2), xxx-xxx.

International Journals

Yeni, S. & Ozdener, N. (2014). An Analysis On Usage Preferences of Learning Objects and Learning Object Repositories Among Pre-service Teachers. Turkish Online Journal of Distance Education (TOJDE), 15 (2), 161-174.

National Journals

Varank, İ., Gecü, Z., & Yeni, S. (2014). Eğitimde Tablet Bilgisayar Kullanımına İlişkin Öğrenci Görüşleri: Bir Durum Çalışması. Kuramsal Eğitimbilim Dergisi, 7(2), 135-147.

Bayram, S., Yeni, S., (2011). Web Tabanlı Eğitsel Çoklu Ortamların Göz İzleme Tekniği ile Kullanışlılık Açısından Değerlendirilmesi. Ahi Evran Üniversitesi Eğitim Fakültesi Dergisi, 12(2), 221-234.

International Conference Publications

Kert, S.B., Erkoç, M.F. & Yeni, S. (2014) Tablet bilgisayar erişimli video ders kayıtlarının öğrencilerin çoklu ortam tasarımı ve üretimi dersi başarısına etkisinin incelenmesi: AVİTAB projesi, 8. Uluslararası Bilgisayar ve Öğretim Teknolojileri Sempozyumu, Edirne.

Gecü, Z., Yeni, S., & Varank, İ. (2013,). Öğrenme Yönetim Sistemi ve Tablet Bilgisayar Kullanımına İlişkin Öğrenci Görüş ve Önerileri. 7th International Computer & Instructional Technologies Symposium. Erzurum.

Yeni, S., Gecü, Z., & Varank, İ. (2013, Haziran). Üniversite Öğrencilerinin Derslerde Mobil Teknoloji Kullanımı ile İlgili Görüşlerinin İncelenmesi. 7th International Computer & Instructional Technologies Symposium. Erzurum.

Yeni, S., & Özdener, N. (2012,). Öğretmen Adaylarının Nesne Ambarlarını ve Öğrenme Nesnelerini Kullanım Durumlarının ve Tercihlerinin İncelenmesi. 6th International Computer and Instructional Technologies Symposium - ICITS. Gaziantep.

Yeni, S. (2012, Şubat). An Analysis on Teachers' and Teacher Candidates' Usage of Internet Based Materials and Awareness of Learning Objects. 4th World Conference on Educational Sciences (WCES). Spain, Barcelona.

Yeni, S. A., & Bayram, S. (2010,). Survey of Web Based Educational Multimedia Using Eye Tracking Method in Terms Of Usability. 4th International Computer And Instructional Technologies Symposium (ICITS). Konya.

National Conference Publications

Yeni, S. (2011, Mayıs). Tamsayılar Eğitsel Yazılım Projesi. Yeni Nesil Eğitim Konferansı.