Adaptive Web-Assisted Learning System for Students with Specific Learning Disabilities: A Needs Analysis Study*

Elif POLAT[a]
Bahcesehir University

Tufan ADIGUZEL
Bahcesehir University

Ozcan Erkan AKGUN
Sakarya University

Abstract

Because there is, currently, no education system for primary school students in grades 1-3 who have specific learning disabilities in Turkey and because such students do not receive sufficient support from face-to-face counseling, a needs analysis was conducted in order to prepare an adaptive, web-assisted learning system according to variables determined by the extent of learning disabilities. The scope of this study was limited to dyslexia, dyscalculia and dysgraphia. Data were collected from five subject area experts (psychologist and special education specialists) using semi-structured interview forms including open-ended questions, 15 parents, at least one of whose children has a specific learning disability and six classroom teachers via surveys including open-ended questions in the 2011-2012 academic year. A matrix diagram was prepared in order to analyze the data with a holistic approach and to show dependability and credibility of the study. The study revealed three main findings: a lack of information / interest about specific learning disabilities, the inadequacy of the Turkish Ministry of Education Specific Learning Disabilities Support Education Program, and the inadequacy of applications, both within and outside the classroom. The findings also showed that the students with specific learning disabilities need a web-assisted system that should be adaptive and which can be used both in school and at home.

Key Words

Needs Analysis, Adaptive Web-assisted Systems, Learning Disability, Dyslexia, Dyscalculia, Dysgraphia.

a   **Elif POLAT** is currently a research assistant at Bahcesehir University and MA student at Computer Education and Instructional Technologies Program at Sakarya University. Her research topics include instructional design and technology, distance education, adaptive learning systems, integrating technology into special education. Correspondence: Res. Assist. Elif POLAT, Bahcesehir University, Faculty of Educational Sciences, Department of Computer Education and Instructional Technologies, 34353, Besiktas/Istanbul/ Turkey. E-mail: elif.polat@bahcesehir.edu.tr Phone: +90 212 381 5341 Fax: +90 212 381 0020.

Education and its sub-concept, learning, have a crucial role in allowing people to pursue quality lives. However, when learning levels of the students are examined, it is clear that every student cannot attain success at the required level nor the quality. Bacanli (2007) stated that schools become the most effective source of children's learning after they start school. But, some students show worse performance than the other students in the classroom and fail to attain predetermined achievement levels. However, a child is expected to be successful if s/he does not have any cognitive, affective, social, visual, audial, behavioral problems. When a child is unsuccessful, all educational stakeholders are affected. At this point, the first thing, which comes to mind, is a progressive problem of the child. But, there are also some children who fail at school

despite not having any specific problem (Demir, 2005). There are many reasons for the lack of success in the learning process, one of which involves specific learning disabilities. Describing learning as acquisition of information, Korkmazlar (1999) defined the difficulties individuals experience while learning as specific learning disability. Barth (2006) states that the children who have specific learning disabilities are the ones who do not reach pre-defined learning objectives. Bateman (1965) described the children with the special learning needs in a similar way as: "the children who have significant differences between the expected success from their mental potentials and their current school success." Another supporting description is that specific learning disabilities are diagnosed when a child's performance on math, written expression and reading in individual and standard tests is not satisfactory according to the child's age, school and intelligence level (APA, 2000).

Some researchers have focused on problem areas in cases of specific learning disabilities and produced a classification according to the problem areas (Altuntas, 2010). When the literature is reviewed, it can be seen that classifications of specific learning disabilities are expressed differently by the different researchers. The most used classification of specific learning disability is: (1) Dyslexia - having problems in reading, spelling and writing (including changing the order of letters and pronunciation; (2) Dyscalculia - having problems calculating numbers or understanding mathematical concepts such as algebra and geometric equations; (3) Dysgraphia – having problems with hand writing (illegible writing, writing the letters with great spaces or in very big forms and spelling problems) (APA, 2000; Kurdoglu, 2005; Siegel, 2007). Opposing these classifications, some specialists (Clark & Uhry, 1995; Myers & Hammill, 1976) claimed that the specific learning disabilities can be very different in each child affected, and such disability can be in a couple of areas in some children, which cannot be classified.

The frequency of specific learning disabilities has been ascribed differently in the literature as well. Korkmazlar (2003) stated the presence of a diagnosed learning disability varies between the 1% (China) to 3% (Venezuela) of the population who attend school. When countries such as USA, UK, Canada, Australia and the Scandinavian countries are considered the proportion of the students who have been diagnosed dyslexia is around 10-15 % (Jansky, 1990). Similarly, in a study conducted on

school age students, it was stated that the proportion of the special learning ratio is around 6-12% (Anderson, 1992). However, in USA the number of the people (between the ages 3 to 21) who have specific learning disabilities reached to 1.680.000 with an increase like 200 % (Digest of Education Statistics Fast Facts, 2010).

When the situation in Turkey is examined, Whirter and Acar (1985) stated that the proportion of learning disability in Turkey was between 1 and 30 %, whereas Erden, Kurdoğlu, Aysev (1999) stated that 10 to 20 percent of children who are at their school age have specific learning disabilities. According to data collected from parents in Demir's (2005) study, 23.5 % of the preschool children and 33.1 % of the children in first grade were considered at-risk; whereas, data collected from their teachers showed that 15.9 % of the preschool children and 24.8 % of children in first grade were at-risk. When checking these percentages, it becomes clear that the specific learning disability affects the learning process in schools.

In comparison to their age group, students with specific learning disabilities cannot read given texts or read problematically, cannot write properly and cannot calculate mathematical operations correctly in their learning process (APA, 2000; Backhouse & Morris, 2005; Banai & Ahissar, 2006; Bateman, 1965; Casalis, Cole, & Sopo, 2004; DCSF, 2005; Geary, 1993; Geary & Hoard, 2001; Habib, 2000; Hamstra-Beltz & Blote, 1993; Kirk & Kirk, 1971; Koontz & Berch, 1996; Selikowitz, 1998; Shafrir & Siegel, 1994; Siegel & Ryan, 1989). This situation is understood by their teachers as reflecting a developmental disorder (Demir, 2005). When no special care is given to such students, their failing reasons at schools even cause them drop out. To illustrate, the school drop-out rate among children with learning disabilities is reported to be 40 % (APA).

Alleviating the negative effects of specific learning disabilities on learning is only possible with special education (Abosi, 2007; APA, 1987; Demir, 2005; Dogangun, 2008). Dogangun (2008) stated that there is no single way to reduce the difficulties faced by children with specific learning disabilities through special education, and if several ways are used together, it can be more beneficial. Moreover, students with the specific learning disabilities are being moved to mainstream classrooms (educating students with special needs in regular classes). However, in such classrooms, there were no special activities done for such students by the classroom

teachers (Altuntas, 2010; Batu, 1998; Bingol, 2003). Similarly, although education sources such as special education departments and Individualized Education Programs (IEP) are increasing, teacher education programs were not fully equipped for preparing teacher candidates to use educational technology (Edyburn, 2004a; Judge & Simms, 2009). Apart from that, the reviewed literature shows that technology was not used a lot by special education teachers whereas there is some research shows the benefits of technology have on special-education (Lahm, 2003; Puckett, 2004). But, providing the special education services to people who have learning disabilities and need these kinds of services is guaranteed by many laws (National Association of Special Education Teachers [NASET], n.d.) such as Law 3797 concerning the organization and duties of Ministry of National Education in Turkey (MNE), and "No Child Left Behind" in United States. In the MNE (2008), Special Education and Rehabilitation Center Specific Learning Disability Support Education Program which was developed by the laws in Turkey, it is stated that the first factor for providing a person's needs is providing him with the education he needs. Like other people, those who need special education have some characteristics, interests and skills and learning needs unique to them. Today's contemporary education's goal is providing an education that takes the person into the center by considering individual differences, characteristics and needs. Developing learning environments and systems which provide an education while satisfying the individual differences such as learning styles, learning preferences, interests etc. can be very beneficial. These environments/systems utilize different solutions such as various teaching strategies to lessen the specific learning disability; IEP in Turkey, USA, and many of the European countries; and educational therapy with a psycho-pedagogic approach. Technology enables these methods and techniques to be used effectively.

Today's technology provides great opportunities and continues to offer novelties that assist students with disabilities to live freely and learn more easily. Developing the learning environments assisted by technology for these students is of great importance in enhancing their learning processes. Although there is much research concerning the use of technology in special education abroad (Edyburn, 2000, 2001, 2002, 2003, 2004b; Hauser & Malouf, 1996; Holburn, Nguyen, & Vietze, 2004; Jimenez et al., 2003; Kelly, 2000; Jeffs, Morrison, & Messenheimer, 2003; Moreno & Saldana, 2005;

Okolo, Bahr, & Reith, 1993; Ryba, Selby, & Nolan, 1995), it is apparent that these kinds of studies have started to become widespread in Turkey in recent years and they are still very few in number (Basoglu, 2009; Bayram, 2008; Catak, 2006; Demirkiran, 2005; Okur, 2006; Sakar, 2008). Therefore, setting down the needs of the students with a specific learning disability is an important subject.

Various insufficiencies have occurred about the efficiency of the current web-based learning systems (Brusilovsky, 1998, 2001; Brusilovsky & Eklund, 1998; Eklund & Brusilovsky, 1999; Frankola, 2001; Kosba, Dimitrova, & Boyle, 2007). As long as the amount of accessible information increases, learning environments, which offer the same content and the same, navigational options cannot satisfy the demands (Brusilovsky, 2001). Traditional computer/web based learning environments offer the same content, the same connections and the same navigation order and they do not consider the individual differences, preferences and interests (Somyurek, 2009)—The problem is that learning material does not take consideration of the students' personal learning needs (Brusilovsky & Eklund, 1998; Hollink, Someren, & Wielinga, 2007). Because of the learning environments' limitations, there is a need to transition from web-based learning environments, which are developed with a motto like "One size fits all", to adaptive web-based learning (Brown, Cristea, Stewart, & Brailsford, 2005; Brusilovsky, 2001; Brusilovsky & Peylo, 2003; Ozyurt, Baki, & Ozyurt, 2011; Sagiroglu, Colak, & Kahraman, 2008; Somyurek, 2008). Studies about such adaptive systems started with the intelligent teaching systems, and increased after the hypermedia started to be used widespread in education (Dag & Erkan, 2010).

Adaptive web-assisted systems can be described as the systems that determine the students' choices, learning styles, interests, and needs and they can adapt themselves according to these characteristics of the students. Adaptive hypermedia systems, in which a "One size does not fit all" approach is accepted, were developed in order to adapt various individual differences including also learning and cognitive styles (Triantafillo, Pomportsis, & Demetriadis, 2003). Apart from offering different content to individuals in adaptive web-assisted learning environments, a navigating support is also provided, which reduces the possibility of coming across content which is inappropriate for the individual. Adaptive systems also prevent the students from having confusion during the learning process and

make learning more effective and efficient (Chang, Lu, & Fang, 2007).

Individuals with a specific learning disability may have different problems from each other (Northfield, 2004). Accordingly, it is thought that learning environments developed for individuals with a learning disability should be adapted to the learning requirements of the individual. According to Mezak and Hoic-Bozic (2003), adaptive systems are a good fit for special education, as they can make use of different types of presentation and be adapted for the users to overcome physical deficiency of the users. According to Schofield et al. (2003), using adaptive systems for education of students with special requirements has many advantages. Since such systems makes learning environments independent from time and location, materials can be accessed at all times. This provides students with the opportunity of repeating learning materials at any time. When the teacher presents the material, she/he should be certain that the student does not take notes incorrectly and that there are no gaps because of school absences. By utilizing the Internet, students can study wherever they want and thus the possibility of falling behind in the class is minimized. In this regard, when the relevant literature is examined, it is clear that studies aiming to build a model for lessening the specific learning disability and improving adaptive learning systems are limited in numbers. On the other hand; although there is experimental research about the design and application of such learning systems at various teaching levels (Brown, Fisher, & Brailsford, 2007; Brusilovsky & Eklund, 1998; Brusilovsky & Pesin, 1998; Juvina & Herder, 2005; Kaplan, Fenwick, & Chen, 1998; Kelly, 2005; Somyurek, 2008; Specht & Kobsa, 1999; Stern, 2001; Schiaffino, Garcia, & Amandi, 2008; Triantafillo et al., 2003), the studies which analyze concepts related to special education, especially with the specific learning disability being the topic, are considerably limited. Limited research dealing with the adaptive learning systems for the students with specific learning disability has been conducted (Athanasaki & et al., 2007; Butterworth & Laurillard, 2010; Tzouveli, Schmidt, Schneider, Symvonis, & Kollias, 2008; Wilson et al., 2006).

For example, Wilson et al. (2006) developed an adaptive game called as "Number Race", designed for the students (5-8 years) experiencing dyscalculia and for teaching numbers. The game was adapted for each child's performance level. Level of performance was determined as "students' ability to understand the difference between numbers", the "duration of answering the question", and "conceptual difficulty". The adaptability of the game software was evaluated by the simulations developed in MATLAB program and the use of the program during 5 weeks, 4 days in a week and 1 hour in a day by the students with dyscalculia. Results of the evaluation showed that the game was adapted successfully according to different levels of students' first knowledge level and learning speed. In the study of Tzouveli et al. (2008) and Athanasaki et al. (2007), instead of providing dyslexic students with a special education environment, software named AGENT-DYSL was developed to provide support for inclusive education. The primary novelties of this approach were to gather "voice recognition", " affective case recognition and adaptation via image recognition" and "specifying error type profile via ontology-based data core" to provide students with individualized support. AGENT-DYSL supported the use of any materials in the classroom, provided sufficient reading help, and thus made the dyslexic students active in traditional teaching environment. AGENT-DYSL system was evaluated in three countries: England, Greece and Denmark. The aim of the system was not only to support use of reading materials in inclusive education, but also to improve reading skills by being adaptive and adjusting according to the learning environment. Another one was "Number Bonds" developed by Butterworth and Laurillard (2010) for the students experiencing dyscalculia. This involved a paper-pencil activity used in special education that aimed to teach the numbers completing each other to 10. While three students in the special education class completed only 1.4 activities during 10 minutes observation, students using "Number Bonds" game completed 4-11 activities in a minute. As a result, they found that by using such adaptive games, students participate in more activities than they do in the classroom with their teachers.

The literature analyzed through this study shows that technology supported systems can be used effectively for decreasing learning problems experienced by the students with specific learning disabilities. It is generally seen that the conducted studies are stand-alone and adaptive. In addition, based on reviewed research, adaptive and web-based learning systems for students experiencing specific learning disability are not used in Turkey. However, at the present time, there is a real need for research on developing and implementing web-assisted and adaptive systems together. Even

computer-assisted studies, developed for the students experiencing specific learning disability, are lacking. Hence, "What are the features of the system that students with a specific learning disability need and that will support them?" is an important and current question to be answered promptly. The aim of this study is to make a need analysis for adaptive web-assisted learning system which will be prepared for the primary school 1st -3rd grade students with specific learning disability (dyslexia, dyscalculia, dysgraphia). It is thought that the findings will contribute to the improvement of the environment and systems which are aimed in national and international extent.

Method

Model

A phenomenological qualitative research method was used in this study. The research design was based on a needs analysis model suggested by Morrison, Ross, and Kemp (2006). Needs analysis and needs assessment concepts are used interchangeably in the literature (Morrison, Ross, & Kemp). Needs analysis can be described as defining the problem or determining whether the problem is solved as a result of teaching, and the complement of activities in the process of finding appropriate solutions for the problem (Kaufman & English, 1979; McArdle, 1998; Morrison et al.; Rosset, 1982). It can be defined as the differences between existing results and desired results, too (Dick, Carey, & Carey, 2005; Kaufman, 1988; McArdle). The steps of this complement of activities were stated differently by different scholars. Witkin and Altschuld (1995) stated these steps as pre-assessment (research), main-assessment (gathering data) and final-assessment (using). McArdle suggested four different needs assessment steps such as monitoring, investigation, analyze and reporting. Morrison et al. (2006) state that needs assessment is composed of four processes such as planning, data collection, data analysis and preparation of the final report. The steps followed in this research were summarized in Table 1. By considering the steps mentioned in the literature and focusing on Morrison, Ross and Kemp (2006)'s model, the following steps were carried out in this study (see Table 1): (1) planning a needs analysis, (2) collecting data based on the plan, (3) analyzing data, and (4) writing final report that brings out the need.

Table 1.
Needs Analysis Model of The Study

Phase I Planning	Phase II Collecting Data	Phase III Analyzing Data	Phase IV Preparing The Final Report
Identify the target group and the audience Identify the data collection tools Identify the method of analysis Identify the participants	Identify the number of participants (sample size) Set a schedule for the data collection	Analyze the data collected Prioritize the needs identified	Preparing The Final Report

Participants

Participants of the study were five subject area experts (see Table 2), six 1st -3rd grade classroom teachers who taught to at least one student with a specific learning disability (see Table 3) and 15 parents, at least one of whose children had specific learning disability. Subject area experts came from the areas of psychology (n = 4) and special education (n = 1), and the special education experts (16-20 years) were more experienced than psychologists (1-15 years). Classroom teachers and some of the parents were contacted via special consulting centers, and some were reached via specific learning disability groups on the social media. One of the classroom teachers was male, the other five were female, their teaching experience was between 7 and13 years, and their ages range between 29 and 35 years. Two of them taught 1st grade, three taught 2nd grade and there was only one 3rd grade classroom teacher. The diagnosis of the children (n = 15) whose parents participated to the study was done by an expert (doctor, psychologist, counseling and research center). Of the 15 students, two were female, the other 13 were male; six were the first grade, five were the second grade and four were the third grade students (see Table 4).

Table 2.

Demographic Information about the Subject Area Experts

Code	Area	Years of experience
SAE 1	Psychology, M.A	0 - 5 Years
SAE 2	Psychology, M.A	0 - 5 Years
SAE 3	Psychology, M.A	6 - 10 Years
SAE 4	Special Education, Ph. D.	16 - 20 Years
SAE 5	Psychological Counseling, M.A.	11 -15 Years

Table 3.

Demographic Information about the Classroom Teachers

Gender	Years of experience	Age	The grade taught by teacher
Female	7	30	3
Male	7	31	1
Female	9	30	1
Female	3	29	2
Female	10	35	2
Female	13	33	2

Table 4.

Demographic Information about the Children

Diagnosed by	Gender	Grade
Doctor	Male	2
Doctor	Male	1
Doctor	Male	1
Psychologist	Male	2
Doctor	Female	3
Counseling and Research Center	Male	1
Doctor	Male	3
Doctor	Male	2
Doctor	Male	2
Psychologist	Female	1
Doctor	Male	1
Psychologist	Male	3
Doctor	Male	3
Doctor	Male	2
Doctor	Male	1

Data Collection

Materials: Three different data collection tools were used in this study: subject area expert interview form, classroom teacher survey and parent survey. The subject area expert interview form was a semi-structured form, and composed of 15 open-ended questions with sub-questions. The questions were about internal/external classroom activities developed for students with specific learning disability, computer/web assisted applications and how the features of these applications should be (in the direction of MNE Specific Learning Disability Assistance Education Program). There were 25 open-ended questions in the survey of classroom teachers and 13 open-ended questions in the survey of parents, which both were related to internal / external classroom activities and computer/web assisted applications, the information and relevancy of the education partners (parent, student, and teacher) about specific learning disability, IEP and MNE Specific Learning Disability Assistance Education Program. Interview form and surveys were developed by the researchers. Related literature and MNE Specific Learning Disability Program were taken into consideration initially to provide content validity. For the comprehensibility, content and face validity of the interview form and the surveys, opinions were taken from three experts (two from Education Technology area, one from Psychology area). The interview form and the surveys were found to be appropriate except for one problem (repetitious questions in the survey of parent). Since there were only open-ended questions in all data collection tools, reliability of them was not tested. Problems were solved in the direction of the feedbacks and reconfirmation was taken from the experts after making the necessary arrangements.

Procedure: Prepared forms and surveys were applied to subject area specialists, classroom teachers and parents on data collection phase during the "2011 – 2012" academic year. A letter of invitation was sent to professionals with experience in special education about "Special Learning Disabilities", and experts who were working in the field of psychology in the subject area for interviewing. Each interview was conducted for about 30 minutes; interviews were recorded with the informed consent of participants. Recorded data were transcribed immediately after discussions. Parts of surveys were administered with the paper-pencil and others were conducted on the Internet by communicating with participants and exchanging questions and answers through an online social media network Facebook. Subject area experts, classroom teachers, and parents were informed about the purpose of the research, surveys and the principle of voluntariness. Each administration took about 15 minutes.

Data Analysis

The main and sub-themes were identified by applying content analysis by two researchers to data obtained from the subject area expert interviews.

While analyzing the content, a better agreement between two researchers was mainly considered and a consensus was obtained by taking opinions from the experts in case of any possible disagreements between two researchers. Also frequencies of sample statements of the experts, and the theme and sub-themes were calculated. Parent and teacher surveys were evaluated separately; answers of open-ended and closed-ended (structured) questions in these assessments were analyzed together. The themes were created according to the results of analysis, and question / question groups under these themes were tabulated by considering the rate of frequency. Constant comparative analysis was used to classify data as selected themes. Triangulation was done with more than one source of data collection to identify and summarize the themes taken from a needs analysis (Onwuegbuzie & Leech, 2005). Table 5 specifies credibility of the study by matching data collection sources with research findings (teachers, subject area experts, parents' thoughts), and shows how data were used for triangulation. The data collecting sources include the subject area expert interview form, as well as the classroom teacher and parent surveys. Each data source provides confirmatory evidence to verify information from other methods. Collecting of data from multiple sources, especially a variety of triangulations prevents commitment to a single data collection method, so any biases in the specific structure of the data sources are negated (Anfara, Brown, & Mangione, 2002).

Table 5.

Matching data collection sources with research findings

THEMES / CATEGORIES	SOURCES OF DATA		
	SAE	Teachers	Parents
A lack of information / interest about specific learning disabilities		X	X
The inadequacy of the Turkish Ministry of Education Specific Learning Disabilities Support Education Program	X	X	X
The inadequacy of applications, both within and outside the classroom	X	X	X

Results and Discussion

Three different themes emerged from data collected from subject area experts, classroom teachers and parents: lack of information / interest about specific learning disabilities, the inadequacy of the Turkish Ministry of Education Specific Learning Disabilities Support Education Program, and inadequacy of in-class and out-class applications.

Lack of Information / Interest about Specific Learning Disabilities

This theme was fed by data from classroom teachers and parents. The classroom teachers ($n = 6$) responded that they had information on specific learning disabilities at different levels: low ($n = 2$), medium ($n = 3$), and high ($n = 1$), which was also found in Altuntas's (2010) study revealing that primary school teachers have a low level knowledge about the dyslexia. Izci (2005) also found that pre-service classroom teachers do not have necessary information and interest regarding special education in general. Aside from the results of the two studies, Yigiter (2005) concluded that primary school teachers' level of knowledge about a specific learning disability was moderate. Demir (2005) also specified that 90.9 % of participating teachers (pre-school and first grade) in the study had knowledge about learning disabilities, but 9.1 % of them did not. On the other hand, all teachers said that they haven't had any service training / seminar / certificate and etc. about specific learning disabilities. Therefore, it can be said that classroom teachers' knowledge level may be a factor when considering students with specific learning disabilities in general classrooms. This issue was also mentioned by Colak and Uzuner (2004) —Teachers' low knowledge about specific learning disabilities may cause them not to separate students with learning disabilities from those with mental disorders since even students with low-level mental disorders may experience delay in gaining reading and writing skills. Similarly, second and fourth grade teachers in Bingol's (2003) study believed that there is a psychological problem or vision or hearing problems or mental retardation for children with reading problems. Demir (2005) also specified that the majority of children with the inclusion report are perceived as mentally retarded in Turkey; and this is a situation that is due to insufficient recognition of learning disabilities.

Regarding the results of discussion with parents, the majority of parents have no knowledge about

(n = 11) specific learning disabilities: of 15 parents, nine (60 %) declared no knowledge, four (26.7 %) said yes, and two (13.3 %) indicated partial knowledge, which was similar to results acquired by Demir (2005) that 64.5 % of families have no knowledge about specific learning disabilities. Parents' responses also revealed that specific learning disabilities were not understood correctly by them and were seen as mental retardation instead. In this context, it can be said that, similar to the teachers' case, the help given by parents' help to children with specific learning disabilities is questionable due to the level of their knowledge. This problem may also be related to parents' education level—Classroom teachers indicated that parents of students who have specific learning disabilities are not equipped to deal with the issues of such students as needed, and to find support for them in general: "[This is not enough. The reason for this] [is] lack of education levels". Akkus (2007) similarly found that 32.6 % of teachers indicated one of the reasons of getting no support by parents was their' low education levels. Overall, classroom teachers and parents' lack of or low-level knowledge about specific learning disabilities is a huge contributing factor to the need for getting assistance from technology designed for helping students with such disabilities.

Inadequacy of Turkish Ministry of Education Specific Learning Disabilities Support Education Program (SLDSP)

Data from classroom teachers, parents and subject area experts contributed to the emergence of this theme. Classroom teachers (n = 6) first indicated they all did not get an in-service training for SLDSP and only four were aware of the SLDSP. Half of classroom teachers specified that SLDSP does not largely meet needs of students and teachers; and program achievements / activities / assessment and evaluation methods / techniques are not adequate enough for supporting students with specific learning disabilities: "[SLDSP] [is] not enough. Children [must] learn in the classroom more comfortably", "a more comprehensive program [must be prepared] [for students with specific learning disabilities]." Still, two teachers said that the SLDSP is taking into consideration the age/level/individual characteristics of students with specific learning disabilities. Only one teacher responded that the SLDSP has strong / superior aspect: "rights of children [with such disabilities] are protected [with SLDSP]." All these findings reveal that a special program is needed for students who experience specific learning disabilities in Turkey that have a significant number of specific learning disability cases (Demir, 2005; Erden et al., 1999; Whirter & Acar, 1985). Another factor to consider is that the program's implementers and classroom teachers who were with students with specific learning disabilities didn't receive any in-service training on the SLDSP. Regarding the implementation of SLDSP, a teacher specified two problems. First, they did not have enough time to conduct SLDSP and, if conducted, the normal program had been hampered in mainstream classrooms, similar to the findings in studies of Batu (1998) and Bingol (2003). Second, because of the large classroom size they were not interested in students with disabilities in the classrooms particularly since they could not ignore other students in the classroom by focusing so much time on students. They also recommended solutions by having special sub-classes using the power of government. All these problems cause students with specific learning disabilities to continuously fail in their learning environments, and increase the drop-out rate.

The vast majority of the parents (n = 12) said that they do not have any information about SLDSP. Of the three parents who were aware of the program at different levels, one noted that the education given within the program does not meet needs of their children; the other two parents stated that the program was at a strong enough level for meeting their children's needs but there were some problems in practice: "the quality of the school and the teachers from which they took their courses were crucial. Although it [SLDSP] is quite enough, it does not carry any importance if the child cannot get the education." The parents also found the program efficient in meeting their own needs as long as it meets their children's needs. Overall, not knowing anything about Turkey Ministry of National Education Learning Disability Training is an important disadvantage. However, the parents—especially the ones of the children who need special education and is accepted the first teachers of their children—should interact continuously with the counselor, classroom teacher and school administration. It is clearly stated in the MNE (2000) Special Education Services Regulation that the parents who have children with special needs should take part in every stage of their children's education. Among the suggestions from the parents; there is being informed in specific learning disability by the experts, individualization of the programs, considering children's emotional aspects, and arranging the program so that parents can help their children more efficiently.

Results from interviews with subject area experts (SAE) revealed that they have a clash of ideas about SLDSP. Some of them (n = 3) stated that SLDSP cannot meet the students' needs, and there are problems in practicing of SLDSP: "In the cases where ideal [SLDSP] is practiced, the program meet students' needs extensively, but whether the students really benefit from it or not is all about if this program is useful in practice or not [SAE3]." Subject area experts also indicated that the program does not have superior, strong aspects and it is not individual, namely, it does not consider the characteristics of students with the specific learning disabilities such as age and level: "[The weaknesses of the program] are that it does not consider individual properties, emotional handicaps [obstacles] and the deficiencies in the application [SAE5]." Two of the experts also added that there is no knowledge about how this consideration is carried out.

> "[SLDSP] is an area in which considering the individual properties is quite hard. There are a lot of typical and non-typical kinds and combinations of specific learning disability. Also the levels differ greatly. The program's information about these differences is very limited, so intervention is also quite limited. This is a great deficiency in the program. [SAE4]."

Although the program was shown to have many deficiencies, there were also some opposing views. Some of the subject area experts (n = 3) counted the superior and strong aspects of the program:

> "As long as the individualized education programs are prepared in a correct way, SLDSP makes the lives of students with the specific learning disabilities easy and enables them to attain their basic needs. Providing specifically the resource rooms and the required materials is an important advantage [SAE3]."

"The program provides extensive information about theoretical and practical application examples. Besides, general special education practices such as preparing individualized education programs are adapted into the learning disability area. It also provides defining information on learning disability [SAE4]." "In my opinion, its strongest aspect is that specific learning disabilities are pointed out and such children's rights are protected [SAE2]." Besides, two of the subject area experts indicated that Turkish MNE does not offer any training about SLDSP: teachers participate in this kind of training when they request to do so or when special events are organized by their schools' counseling services.

When the findings obtained from the subject area experts' interviews are considered, it can be arisen that SLDSP is insufficient in providing for the needs of students and teachers, especially in practice. Not taking into consideration characteristics of the students with specific learning disabilities was accepted by subject area experts as an essential weakness. In addition to that, subject area experts stated that the teachers do not take the necessary training related to the program. For developing the program, the following was suggested by SAEs: training the practitioners and the teachers continuously, cooperating with field specialists in all stages of the program, increasing the awareness of school administrations about the subject, having implementation examples according to the specific learning disabilities, and offering the materials to the teachers by standardizing them are all recommended. Thus, the subject area experts should take part in developing adaptive learning systems which can be used especially in reducing the similar problems in the practice level and featuring advanced individual characteristics of learners.

Inadequacy of Applications both within and outside the Classroom

This theme emerged as result of data obtained from classroom teachers, parents and subject area experts. Of the six classroom teachers, four developed only in-class activities for the students with the specific learning disabilities, only one developed a computer/web-assisted material, and the other one did not develop any application. None of the classroom teachers (n = 6) indicated they used any prepared activity or application for their students with the specific learning disabilities. Some of the classroom teachers (n = 4) said that they used IEP some of which were prepared by themselves and by Counseling and Research Center. These findings were also similar to some studies (Altuntas, 2010; Batu, 1998; Bingol, 2003) in the literature. To illustrate, in his research, Altuntas revealed that the classroom teachers did not do any special study for the dyslectic students in inclusive classrooms; they only had some applications such as redoing, showing patience, offering additional time and giving the level of work suitable for such students.

In helping children with special education need to reach the progressive goals, computer technology

has taken a major step forward over the last decade. The use of computer technologies makes children with special education needs active in exploring the world in a more successful way, communicating with others for their own needs and making choices for their own lives. Computer applications serve as an equalizer (balancer) so that a child with special education needs and children without can do similar activities (Hutinger, 1996). In a similar way, by stating that the educational technology has started to be used more frequently in the education of the students with special needs, as in all the other areas of education, Demirkıran (2005) accepts that educational technology has a very important place in enhancing the experiences of children with special education needs, making the learning process easier and providing them with the individualized education. Sevinc (1996) states that computer use in special education supports children's many development areas such academic successes, their hand-eye coordination, finite motor skills and imitation and language skills. It also gives a boost to the development of basic areas such as math and literacy. Workshops, in-service educations, seminars and courses can be organized in order to use and develop these beneficial computer/web assisted applications. The teachers should be given training not only on how they are going to develop it or find it, but also on how they are going to use them in their classrooms.

More than half of the parents ($n = 11$) said one of the leading applications used by the parents for their children's education was the use of books. Among the other applications used, there were study sheets ($n = 7$), and computer-/web-assisted software (games, exercises etc.) ($n = 6$). Besides, the parents indicated their most important expectations from the schools of their children as the following:

> "The teachers should prepare the materials for the students with the specific learning disabilities, they should give different homework from other students in the classroom ($n = 9$), they should inform the parents about the students ($n = 11$) and about the students' progress periodically ($n = 13$), the individual training program used for the student ($n = 13$), and the materials (CD, web sites, education software, book etc.) parents can use outside the school ($n = 11$)."

Almost all the parents ($n = 14$) stated that their children need an education system which can be adapted according to their children's individual differences and accessible through the Internet: "As a mother, searching in that area has been the most important thing in my life for two years. A web site that will be beneficial to our children is going to make me happy," "My child is in front of the computer half an hour on weekdays and one hour on weekends and my son having dyslexia has a visual intelligence and therefore he learns more rapidly by seeing," "My child needs a learning system which can be adapted according to his individual characteristics and he can reach through web, because studying with the systems adaptive through web is the easiest way."

To summarize the results from parents, it can be said that books were the first source to be used by the parents for the education of their children outside of the school, which was also found in Demir (2005). The reason for this may be that parents find the books more confidential compared to other sources. Moreover, about 1 of 3 of the parents declared that they make use of the computer-/web-assisted materials. This circumstance may be counted as a sign that computer-/web-assisted applications are accepted by the parents and start to be widespread. When viewed through the expectations of the parents, it is seen that there is a desire for individualized education, paying attention to private learning disability during learning processes, special materials for the students with learning disability, homework and periodical information about the students' progress. This property points out the adaptive, web-assisted learning system, because adaptive systems deal with the students one by one (Brusilovsky, 2003), namely, they can be adjusted for the different students' learning requirements by taking into consideration the information gathered for different students (Brusilovsky, 2001; Brusilovsky & Peylo, 2003; De Bra, Aroyo, & Chepegin, 2004). The students' differences reveal different requirements in the same learning environment such as preliminary information levels, skills, characteristic features, learning styles and learning preferences (Conati, 2002; Park & Lee, 2004; Riding & Rayner, 1998). Adaptive systems fulfill the requirements of the different individuals by being attuned to individual differences including learning and cognitive styles (Ayersman & Minden, 1995). Accordingly, it is thought that students complete expected tasks more effectively when the education system is adapted to individual differences (Federico, 2000; Popescu, 2010; Triantafillo, Pomportsis, Demetriadis, & Georgiadou, 2004).

Moreover, the system developed in the research done by Tzouveli et al. (2008) and Athanasaki et al. (2007) which was designed to be easy enough to be used individually by the students, exercise-based and which includes voiced materials to take place of written materials for dyslectic students offers each student a personal display and personal feedback. The other design principle is the adaptability which can imitate a good teacher by adjusting the duties for the requirements of the student. The aim is to accomplish what teachers do, to strengthen learning, at the same time to keep the student in the zone of proximal development to create concepts and make the duties more challenging and to develop the software which will be adjusted to student's present comprehension.

Regarding the responses from subject area experts, some ($n = 2$) specified that practices in the classroom for students who experience specific learning disabilities are not common, but are limited to materials prepared by the teacher if the teacher has knowledge about this subject, and therefore, in-classroom practices are insufficient. Two subject area experts specified that in-classroom practices were not done; and others ($n = 3$) specified that practices outside the classroom were provided by private institutions (counseling centers, private hospitals and clinics, etc.) but these applications were problematic: "outside of class, parents try to get special support for their children from persons who are working in various institutions, from different disciplines, but often taught themselves by informal ways, sometimes has no knowledge of the subject [SAE4].", "applications outside the classroom can be provided by private clinics or hospitals, which requires parents to pay for them. So, the government must supply such applications to support all foundations [SAE2]."

Almost all subject area experts ($n = 4$) specified that there are no computer / web based systems developed for students with specific learning disabilities; and one indicated that there were such systems, but he had no information about the adequacy of them. All of the experts ($n = 5$) specified that there is a need for such systems in all areas of specific learning disabilities (dyslexia, dyscalculia, and dysgraphia): "[through computer / web based systems] tracking of student will be easy. The visual elements allow more focusing of children. Also children [will] work with the computer without pressure [SAE1]", "[Through computer / web based systems] many of the mental exercises can be made on the computer and so this can become more ac-

cessible, fun and attractive for the kids, [SAE3]", "They must be programs that demonstrate flexibility as to age, level, and individual differences and practitioners and experts must be specialist, person and the program must have feedback quality [SAE 5]." Two subject area experts also said that such software must be individually used outside of school and on the Internet:

> "It must be software that can be used on the Internet outside the school because it is easier to access. If it is software that is used on the computer in lab with teacher, children cannot access to it later [SAE 1]", "I think, it must be teacher-assisted and also individually used software. Family and peers can be involved in this [SAE4]."

When findings from subject area experts were evaluated it seems that applications in the classroom are insufficient; however applications outside the classroom are not reliable generally and force parents' to spend money. It was also clarified that computer / web based materials for students with specific learning disabilities do not exist; but specific learning disability (dyslexia, dysgraphia, and dyscalculia) needs such systems. Students who have less motivation in the classroom can work on the computer installed with such learning systems without pressure; and this situation will help students regain their lost motivation. In fact, since the computer is not judgmental towards children it also has an important position in special education. Children with learning disabilities get used to failure, but there is no judgmental situation even if they have a lot of errors during computer interaction. In order to avoid a problem of failing again, considering such technologies and strategies is important (UNESCO, 2000). Providing full support and presenting a sufficient amount of positive reinforcement by a program without teacher supervision creates a learning environment where students can be confident and motivated (Athanasaki et al., 2007; Tzouveli et al., 2008; Wilson et al., 2006). Based on answers and recommendations from subject area experts, the system features that must be present for effectiveness (providing visual and auditory elements, interactive, being tailored to the needs, including reinforcement systems, making appropriate choices for learning styles, giving feedback, and including measurement and evaluation system) point to adaptive systems (Athanasaki et al.; Butterworth & Laurillard, 2010; Tzouveli et al., 2008; Wilson et al.). One of the points that were mentioned was the consolidation of the system for

the points not only where the child is missing, but also in areas in which the child has already demonstrated understanding.

Conclusion and Recommendations

This study examined the conditions of children between 1st and 3rd grades with specific learning disabilities and tried to bring out whether there is a need for adaptive web-assisted application to alleviate such disabilities. Three data sources — responses from classroom teachers, subject area experts and parents one of whose children has specific learning disability— were used to identify themes related to the conditions and the needs. The themes were lack of information / interest about specific learning disabilities, the inadequacy of Turkish Ministry of Education Specific Learning Disabilities Support Education Program, and the inadequacy of in-class applications and the ones outside the class.

The first theme brings out that teachers know about specific learning disabilities, but their level of knowledge is low to moderate whereas the majority of parents did not have a sufficient level of knowledge about such disabilities, which are parallel to results in Yigiter (2005) and Demir (2005). When the publishing dates of these two studies are considered it can be said that no progress has been made about understanding and diagnosing specific learning disabilities. Therefore, studies are needed to inform related bodies so they can diagnose students with specific learning disabilities and to support such students in their learning when needed. In-service trainings and workshops can be organized to inform parents and classroom teachers.

Regarding the second theme, SLDSP is seen as insufficient and its implementation in inclusive classrooms is really difficult because of the time and motivation variables. It is also not known by the majority of parents. When taking into the consideration of students with learning disabilities who need more individual support than other students, education program for such students which are not implemented adequately in schools and supported by the parents at home reveals a major problem to be addressed as a priority. Therefore, Turkish Ministry of National Education faces major tasks in reducing and eliminating these problems. The Turkish Ministry of National Education needs to organize in-service trainings and workshops on the subject of the Learning Disability Support Training Program. Also, experts should inform

teachers about how they may to benefit from these programs, practice them and plan the education intended for the students. Besides, the Turkish Ministry of National Education needs to make various regulations with the cooperation of experts, teachers, and parents. Also, the use of web-assisted technologies has an important place in supporting students with specific learning disabilities. Moreover, the adaptive learning systems developed to be used in crowded classrooms can both meet the students' learning needs and support the classroom teachers in the teaching environments by considering individual profiles. In addition, cooperation with parents of students with special disabilities in learning generally falls within the responsibility of Turkish MNE and lies within the responsibility of students in schools particularly. Incorporating the parents in the process of education is also important in practicing the education program in a more efficient way. Thus, web-assisted learning systems with the remote access can satisfy the needs and consider the suggestions by being open to the parents so that they take an active role in their children's education with specific learning disabilities and they can follow their children's progresses.

According to the third theme fed by teachers, parents and subject area experts' opinions, teaching materials and learning activities are not used enough either at school or after-school. None of the participant classroom teachers use any activities or material designed specifically for the needs of individual students with specific learning disabilities. It was shown that the most applicable and necessary technology in the use of both school and non-school that responds to the individual needs of students is the adaptive web-assisted learning system.

To conclude, it is unfortunately seen that students with specific learning disabilities are not at the expected level and quality based on the literature of special education studies. When teachers, parents and subject area experts' opinions are taken into account, the followings can be recommended to meet the needs of such students and related circumstances:

- Informing parties more about the specific learning disabilities (in-service trainings, workshops, etc.); updating of the education program; developing the quality of educational services; preparation of processes and materials to support the students for not only in school, for out of school life; and the effective use of all these are necessary.

- By considering working conditions of teachers of students with specific learning disabilities; special arrangements that supply optimal conditions (less number of students, co-teacher in the classroom, stipend for extra work, etc.) for teachers to implement the SLDSP are needed, parents should be informed about the program and included in the process at home to increase the program success, examining of the program's effectiveness and making the necessary developments (accountability) are necessary.

- Adapting teaching materials according to the individual characteristics of students and even to the characteristics that only student can study by the aid of their teachers and parents will contribute to standardization of education and the quality.

Apart from some physical regulations and academic studies, educational technology can be a very important contributor, which is the requirement of the digital era. In special education, education technology is used in the form of discovering learning environments such as special instructional software, simulations, games and virtual environments; drills and practices; and evaluating tools, which offer an individualized learning environment to the students. Florian (2004) illustrated that there are some tools which enable teachers to diagnose a learning disability and evaluate them more easily and rapidly. In addition to diagnosing the learning disability, since the teachers of the students with special education needs should also prepare IEPs and observe the students' progress, he also added that much software was developed in order to enable the teachers to carry their daily responsibilities relating to students with the special education needs. Overall, reviewed literature clarifies that the use of technology in special education has positive effects on academic success and developments (Demirkiran, 2005; Jimenez et al., 2003; Martin, 2006; Mechling, Gast, & Langane, 2002; Stetter & Hughes, 2011; Zhang, 2000). Therefore, today's technology should be beneficial in resolving some problems and coping with some inadequacies. This study polishes the needs being satisfied with academic and physical improvements, and also highlights that today's technologies, in particular adaptive and web-assisted ones, can definitely contribute to this process.

References

Abosi, O. (2007). Educating children with learning disabilities in Africa. *Learning Disabilities Research & Practice, 22* (3), 196-201.

Akkus, N. (2007). *Orta düzeyde öğrenme yetersizliği (eğitilebilir) olan çocuklara günümüzde uygulanan ilköğretim eğitim programına ilişkin öğretmen görüşlerinin değerlendirilmesi.* Published master's thesis, Cukurova University, Adana.

Altuntas, F. (2010). *Sınıf öğretmenlerinin disleksiye ilişkin bilgileri ve dislektik öğrencilere yönelik çalışmaları.* Published master's thesis,. Hacettepe University, Ankara.

Anderson, V. (1992). Why do intelligent children have learning difficulties? The neuropsychological perspective. *Journal of Pediatrics and Child Health, 28,* 278-280.

Anfara, V. A., Brown, K. M., & Mangione, T. L. (2002). Qualitative analysis on stage: Making the research process more public. *Educational Researcher, 31* (7), 28-38.

APA (American Psychiatric Association). (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev). Washington, DC: Author.

APA (American Psychiatric Association). (2000). *Diagnostic and statistical manual* (4th ed.). Washington, DC: Author.

Athanasaki, M., Avramouli, M., Karpouzis, K., Kollias, S., Ntalianis, K., Schmidt, A., et al. (2007). *Agent-dysl: A novel intelligent reading system for dyslexic learners.* eChallenges Conference, The Hague, Netherlands.

Ayersman, D. J., & Minden, A. V. (1995). Individual differences, computers, and instruction. *Computers in Human Behavior, 11* (3-4), 371–390.

Bacanli, H. (2007). *Eğitim psikolojisi* (9th ed.). Ankara: Pegem A Publishing.

Backhouse, G., & Morris, K. (2005). *Dyslexia? Assessing and reporting: The Patoss Guide.* UK: Hodder Education.

Banai, K., & Ahissar, M. (2006). Auditory processing deficits in dyslexia: Task or stimulus related? *Cerebral Cortex, 16* (12), 1718-1728.

Barth, K. (2006). *Öğrenme güçlüklerini erken tespit etmek.* (trans. A. Kanat). Izmir: Ilya Izmir Publications. (Original work published in 1997)

Basoglu, E. D. (2009). *Zihinsel engelli öğrenciler için bir eğitim yazılımının geliştirilmesi, uygulanması ve değerlendirilmesi.* Published master's thesis, Sakarya University, Sakarya.

Bateman, B. (1965). Learning disabilities: An overview. *Journal of School Psychology, 3* (3), 1–12.

Batu, E. S. (1998). *Özel gereksinimli öğrencilerin kaynaştırıldığı bir kız meslek lisesindeki öğretmenlerin kaynaştırmaya ilişkin görüş ve önerileri.* Unpublished master's thesis, Anadolu University, Eskisehir.

Bayram, S. (2008). Bilgisayar destekli özel eğitim III. *İstanbul Otizm Eğitim Günleri* içinde. Istanbul, Turkey.

Bingol, A. (2003). Ankara'da ilkokul 2. ve 4. sınıf öğrencilerinde gelişimsel disleksi oranı. *Ankara University Tıp Fakültesi Mecmuası, 56* (2), 67–82.

Brown, E., Cristea, A., Stewart, C., & Brailsford, T. (2005). Patterns in authoring of adaptive educational hypermedia: A taxonomy of learning styles. *Educational Technology & Society, 8* (3), 77-90.

Brown, E., Fisher, T., & Brailsford, T. (2007). Real users, real results: examining the limitations of learning styles within AEH. In *Proceedings of the Eighteenth ACM Conference on Hypertext and Hypermedia (Hypertext 2007)* (pp. 57-66).

Brusilovsky, P. (1998, August). Adaptive educational systems on the World Wide Web: A review of available technologies. In *Proceedings of Workshop "WWW-Based Tutoring" at 5th International Conference on Intelligent Tutoring Systems (ITS'98)* (pp. 16-19.). San Antonio TX.

Brusilovsky, P. (2001). Adaptive hypermedia. *International Journal of User Modeling and User-Adapted Interaction, 11* (1/2), 87-110.

Brusilovsky, P. (2003). Adaptive navigation support in educational hypermedia: the role of students knowledge level and the case for meta-adaptation. *British Journal of Educational Technology, 34* (4)487–497.

Brusilovsky, P., & Eklund, J. (1998). A study of user model based link annotation in educational hypermedia. *Journal of Universal Computer Science, 4* (4), 429-448.

Brusilovsky, P., & Pesin, L. (1998). Adaptive navigation support in educational hypermedia: An evaluation of thesis-tutor. *Journal of Computing and Information Technology, 6* (1), 27-38.

Brusilovsky, P., & Peylo, C. (2003). Adaptive and intelligent Web-based educational systems. In P. Brusilovsky & C. Peylo (Eds.), *International Journal of Artificial Intelligence in Education* [Special Issue on Adaptive and Intelligent Web-based Educational Systems], *13* (2-4), 159-172.

Butterworth, B., & Laurillard, D. (2010). Low numeracy and dyscalculia: identification and intervention. *ZDM Mathematics Education, 42,* 527–539.

Casalis, S., Colé, P., & Sopo, D. (2004). Morphological awareness in developmental dyslexia. *Annals of Dyslexia, 54* (1), 114-138.

Catak, A. (2006). *Powerpoint sunu programıyla hazırlanan okuma materyalinin eğitilebilir zihin engelli öğrencilerin okuduğunu anlama becerisi üzerine etkisi.* Published master's thesis, Abant Izzet Baysal University, Bolu.

Chang, Y-H., Lu, T-Y., & Fang, R-J. (2007). An adaptive e-learning system based on intelligent agents. *Proc. of the 6th WSEAS International Conference on Applied Computer Science* (pp. 200-205).

Clark, D. B., & Uhry, J. K. (1995). *Dyslexia: Theory and practice of remedial instruction* (2nd ed.). Baltimore, MD: York Press.

Colak, A., & Uzuner, Y. (2004). Zihin özürlü çocukların okuma yazma öğrenmeleri ve özel eğitim öğretmenleri yarı yapılandırılmış görüşme araştırması. *Kuram ve Uygulamada Eğitim Bilimleri, 4* (2), 241-270.

Conati, C. (2002). Probabilistic assessment of user's emotions in educational games. *Journal of Applied Artificial Intelligence, 16* (7-8), 555-575.

Dag, F., & Erkan, K. (2010). Bireyselleştirilmiş öğretim sistemleri ve yeni yaklaşımlar. *International Educational Technologies Conference (IETC 2010), 1,* 233-236.

DCSF. (2005). *Data Collection by Type of Special Educational Need: overview.* London: DCSF. Retrieved May 2, 2012 from http://dera.ioe.ac.uk/7736/1/DFES-1889-2005.pdf

De Bra, P., Aroyo, L., & Chepegin, V. (2004). The next big thing: Adaptive web-based systems. *Journal of Digital Information, 5* (1), Article 247.

Demir, B. (2005). *Okulöncesi ve ilköğretim birinci sınıfa devam eden öğrencilerde özel öğrenme güçlüğünün belirlenmesi.* Published master's thesis, Marmara University, Istanbul.

Demirkiran, A. V. (2005). *Özel eğitim kurumlarında bilgisayar kullanımı ile özel eğitim meslek elemanlarının bilgisayar destekli eğitime ilişkin görüşleri ile bilgisayar tutumlarının belirlenmesi.* Published master's thesis, Marmara University, Istanbul.

Dick, W., Carey, L., & Carey, J. O. (2005). *The systematic design of instruction.* Boston: Allyn & Bacon.

Digest of Education Statistic Fast Facts. (2010). Retrieved 10.07.2012 from http://nces.ed.gov/fastfacts/display.asp?id=64

Dogangun, B. (2008). Özel Eğitim Gerektiren Psikiyatrik Durumlar. In *Türkiye'de Sık Karşılaşılan Psikiyatrik Hastalıklar Sempozyum Dizisi, 62,* (pp. 157-174).

Edyburn, D. L. (2000). 1999 in review: A synthesis of special education technology literature. *Journal of Special Education Technology, 15* (1), 7-18.

Edyburn, D. L. (2001). 2000 in review: A synthesis of special education technology literature. *Journal of Special Education Technology, 16* (2), 5-25.

Edyburn, D. L. (2002). 2001 in review: A synthesis of special education technology literature. *Journal of Special Education Technology, 17* (2), 5-24.

Edyburn, D. L. (2003). 2002 in review: A synthesis of special education technology literature. *Journal of Special Education Technology, 18* (3), 5-28.

Edyburn, D. L. (2004a). Rethinking assistive technology. *Special Education Technology Practices, 5* (4), 16-23.

Edyburn, D. L. (2004b). 2003 in review: A synthesis of special education technology literature. *Journal of Special Education Technology, 19* (4), 57-80.

Eklund, J., & Brusilovsky, P. (1999). Interbook: An adaptive tutoring system. *UniServe Science New, 12,* 8–13.

Erden, G., Kurdoglu, F., & Aysev, A. (1999). *Özgül öğrenme güçlüğü anne babalar için el kitabı.* Ankara: Novartis.

Federico, P. (2000). Learning styles and student attitudes toward various aspects of network-based instruction *Computers in Human Behavior 16,* 359–379.

Florian, L. (2004). *Use of technology that supports children with special educational needs.* In Florian, L. & Hegarty, J. (Eds.), *ICT and special educational needs Maidenhead:* OUP (pp. 7-20).

Frankola, K. (2001). Why online learners dropout. *Workforce, 10,* 53-63.

Geary, D. C. (1993). Mathematical disabilities: Cognition, neuropsychological and genetic components. *Psychological Bulletin, 114,* 345–62.

Geary, D. C., & Hoard, M. K. (2001). Numerical and arithmetical deficits in learning-disabled pupils: Relation to dyscalculia and dyslexia. *Aphasiology, 15* (7), 635–47.

Habib, M. (2000). The neurological basis of developmental dyslexia: An overview and working hypothesis. *Brain, 123,* 2373–2399.

Hamstra-Beltz, L., & Blote, A. W. (1993). A longitudinal study on dysgraphic handwriting in primary school. *Journal of Learning Disabilities, 26* (10), 689-699.

Hauser, J., & Malouf, D. (1996). A federal perspective on special education technology [Electronic version]. *Journal of Learning Disabilities, 29,* 504-512.

Holburn, S., Nguyen, D., & Vğetze, P. M. (2004). Computer-assisted learning for adults with profound Multiple disabilities. *Behavioral Interventions, 19* (1), 25-37.

Hollink, V., Someren M. V., & Wielinga, B. J. (2007). Discovering stages in web navigation for problem-oriented navigation support. *User Modeling and User-Adapted Interaction,Springer Netherlands, 17,* 183-214.

Hutinger, P. (1996). Computer application in programs for young children with disabilities: Recurring themes. *Focus on Autism and Other Developmental Disabilities, 11* (2), 105-114.

Izci, E. (2005). Sınıf Öğretmeni Adaylarının "Özel Eğitim" Konusundaki Yeterlikleri. *Elektronik Sosyal Bilimler Dergisi, 4* (14), Retrieved 12.08.2012 from http://www.esosder.com/dergi/14106-114.pdf

Jansky, J. J. (1990). Developmental reading disorder: Specific developmental disorders of childhood and adolescence. *Comprehensive Textbook of Psychiatry, 3* (3), 1692-1699.

Jeffs, T., Morrison, W. F., & Messenheimer, T. (2003). A retrospective analysis of technological advancements in special education. *Computers in the Schools*, 20 (1/2), 129-152.

Jimenez, J., Ortiz, M., Rodrigo, M., Hernandez-Valle, I., Ramirez, G., Estevez, A. et al. (2003). Do the effects of computer-assisted practice differ for children with reading disabilities with and without IQ-achievement discrepancy? *Journal of Learning Disabilities, 36* (1), 34-47.

Judge, S., & Simms, K. A. (2009). Assistive technology training at the pre-service level: A national snapshot of teacher preparation programs. *Teacher Education and Special Education, 32,* 33-44.

Juvina, I., & Herder, E. (2005, July). The impact of link suggestions on user navigation and user perception. In *UM2005 User Modeling: Proceedings of the Tenth International Conference* (pp. 24-29). Edinburgh, UK,

Kaplan, C., Fenwick, J., & Chen, J. (1998). Adaptive hypertext navigation based on user goals and context. In P. Brusilovsky, A. Kobsa, & J. Vassileva (Eds.), *Adaptive hypertext and hypermedia* (pp. 45-69). Dordrecht: Kluwer Academic Publishers.

Kaufman, R. (1988). *Planning educational systems: A results-based approach.* Lancaster, PA: Technomic Publishers.

Kaufman, R. A., & English, F. W. (1979). *Needs assessment: Concept and application.* Eaglewood Cliffs, N.J.: Educational Technology Publications.

Kelly, D. (2005). *On the dynamic multiple intelligence informed personalization of the learning environment.* Published doctoral dissertation, University of Dublin.

Kelly, R. (2000). Working with WebQuests: Making the web accessible to students with disabilities. *Teaching Exceptional Children, 32* (6), 4–13.

Kirk, S., & Kirk, W. D. (1971). *Psycholinguistic learning disabilities: Diagnosis and remediation.* Chicago: University of Illinois Press.

Koontz, K. L., & Berch, D. B. (1996). Identifying simple numerical stimuli: Processing inefficiencies exhibited by arithmetic learning disabled pupils. *Mathematical Cognition, 2* (1), 1–23.

Korkmazlar, U. (1999). Özel öğrenme bozukluğu (öğrenme güçlükleri). In A. Eksi (Ed.), *Ben hasta değilim* (pp. 285-299). Istanbul: Nobel Medicine Publishing.

Korkmazlar, U. (2003). Özel öğrenme bozukluğu. In A. Kulaksizoglu (Ed.), *Farklı gelişen çocuklar.* Istanbul: Remzi Bookstore.

Kosba, E., Dimitrova, V., & Boyle, R. (2007). Adaptive feedback generation to support teachers in web-based distance Education. *User Modeling and User-Adapted Interaction,Springer Netherlands, 17,* 379-411.

Kurdoglu, F. (2005). *Özel öğrenme bozukluğunda tanı ve değerlendirme. Dikkat eksikliği hiperaktivite bozukluğu ve öğrenme güçlüğü* (pp. 43-55). Ankara: Ankara University Tıp Fakültesi Çocuk ve Ruh Sağlığı ve Hastalıkları Anabilim Dalı Yayınları, 4.

Lahm, E. (2003). Assistive technology specialists. *Remedial and Special Education, 24,* 141-153.

Martin, S. S. (2006). Special education, technology, and teacher education. *ForeSITE, 1* (1). Retrieved 25.08.2012 from site.aace.org/pubs/foresite/SpecialEducation.pdf

McArdle, G. (1998). *Conducting a needs analysis: A fifty minute book.* Boston: Course Technology Crisp.

Mechling, L., Gast, D., & Langone, J. (2002). Computer-based video instruction to teach persons with moderate intellectual disabilities to read grocery aisle signs and locate items. *Journal of Special Education, 35,* 224–240.

Mezak, J., & Hoic-Bozic, N. (2003). An approach to modeling adaptive hypermedia for children with disabilities. *Proceeding of the 3rd IEEE International Conference on Advanced Learning Technologies*, IEEE Computer Society.

Ministry of National Education in Turkey (MNE). (2000). *Özel eğitim hizmetleri yönetmeliği.* Ankara: Milli Egitim Publishing.

Ministry of National Education in Turkey (MNE). (2008). *Özel eğitim ve rehabilitasyon merkezi özel öğrenme güçlüğü destek eğitim programı.* T.C. Milli Egitim Bakanligi Özel Öğretim Kurumları Genel Müdürlüğü, Ankara.

Moreno, J., & Saldana, D. (2005). Use of a computer-assisted program to improve metacognition in persons with severe intellectual disabilities. *Research in Developmental Disabilities*, 26 (4), 341–354.

Morrison, G. R., Ross, S. M., & Kemp, J. E. (2006). *Designing effective instruction* (5th. ed.). New York: John Wiley.

Myers, P. I., & Hammill, D. (1976). *Methods for learning disorders* (2nd. ed.). New York: Wiley.

National Association of Special Education Teachers. (n.d.). *Legal information in special education*. Retrieved 14.07.2012, from http://www.naset.org/specialedlaw01.0.html

Northfield, J. (2004). *Factsheet – What is a learning disability?* Kidderminster: British Institute of Learning Disabilities.

Okolo, C. M., Bahr, C. M., & Reith, H. J. (1993). A retrospective view of computer-based instruction. *Journal of Special Education Technology*, 12 (1), 1-27.

Okur, M. R. (2006). *Özel eğitimde web portalı tasarımı (özel gereksinimli çocukların ailelerine yönelik bir web portalı uygulaması)*. Published master's thesis, Anadolu University, Eskisehir.

Onwuegbuzie, A. J., & Leech, N. L. (2005). *Linking research questions to mixed methods data analysis procedures.* Paper presented at the annual meeting of the Southwest Educational Research Association, New Orleans, LA.

Ozyurt, O., Baki, A., & Ozyurt, H. (2011). Uzwebmat: A framework for expert system based on personalized adaptive and intelligent tutoring system for mathematics. *IADIS International Conference e-Learning 2011, 173-180,* Roma, Italy.

Park, O., & Lee, J. (2004). Adaptive instructional systems. In D. H. Jonassen (Ed.) *Handbook of Research for Educational Communications and Technology* (pp. 651-685). Mahwah, NJ: Lawrence Erlbaum.

Popescu, E. (2010). Adaptation provisioning with respect to learning styles in a web-based educational system: an experimental study. *Journal of Computer Assisted Learning, 26* (4), 243–257.

Puckett, K. S. (2004). Project ACCESS: Field testing an assistive technology toolkit for students with mild disabilities. *Journal of Special Education Technology, 19* (2), 5-17.

Riding, R., & Rayner, S. (1998). *Cognitive styles and learning strategies.* London: David Fulton Publishers.

Rosset, A. (1982). A typology for generating needs assessments. *Journal of Instructional Development, 6* (1), 28-33.

Ryba, K., Selby, L., & Nolan, P. (1995). Computers empower students with special needs. *Educational Leadership, 53* (2), 82-85.

Sagiroglu, S., Colak, I., & Kahraman, H. T. (2008). Transition to adaptive educational hypermedia systems from web based educational systems: review of design approaches for the AEHS. *Journal of the Faculty of Engineering and Architecture of Gazi University, 23* (4), 837-852.

Sakar, C. (2008). *Otistik öğrencilere yönelik eğitsel yazılım tasarlama, geliştirme ve değerlendirme sürecinin incelenmesi.* Published master's thesis, Marmara University, İstanbul.

Schiaffino, S., Garcia, P., & Amandi, A. (2008). eTeacher: Providing personalized assistance to e-learning students. *Computers & Education, 51* (4), 1744-1754.

Schofield, S. J., Hine, N. A., Arnott, J. L., Joel, S. D., Judson, A., & Rentoul, R. M. S. (2003). *The adaptive learning environment: Customizing the system to the users' accessibility needs.* Proceedings of 7th European Conference for the Advancement of Assistive Technology (pp.165-169). Dublin, Ireland, 31st. August – 3rd. Sept 2003. Amsterdam: IOS Press.

Selikowitz, M. (1998). *Dyslexia: The facts* (2nd ed.). US: Oxford University Press.

Sevinc, S. (1996). *İşitme kayıplı çocuklarda eğitimci tarafından verilen eğitim ile bilgisayar destekli eğitimin karşılaştırılması.* Unpublished master's thesis, Hacettepe University, Ankara.

Shafrir, U., & Siegel, L. S. (1994). Subtypes of learning disabilities in adolescents and adults. *Journal of Learning Disabilities, 27* (2), 123–34.

Siegel, L. S., & Ryan, E. B. (1989). The development of working memory in normally achieving and subtypes of learning disabled pupils. *Pupil Development, 60,* 973–80.

Siegel, M. L. (2007). *Nolo's IEP guide learning disabilities* (3rd ed). Berkeley, CA: NOLO.

Somyurek, S. (2008). *Uyarlanabilir eğitsel web ortamlarının öğrencilerin akademik başarısına ve gezinmesine etkisi.* Published doctotal dissertation, Gazi University, Ankara.

Somyurek, S. (2009). Uyarlanabilir öğrenme ortamları: Eğitsel hiper ortam tasarımında yeni bir paradigma. *Bilişim Teknolojileri Dergisi, 2* (1), 29-38.

Specht, M., & Kobsa, A. (1999). Interaction of domain expertise and interface design in adaptive educational hypermedia. *Proceedings of the Second Workshop on Adaptive Systems and User Modeling on the World Wide Web* (pp. 89-93). Banff, Canada,

Stern, M. K. (2001). *Using adaptive hypermedia and machine learning to create intelligent web-based courses.* Published doctotal dissertation, University of Massachusetts.

Stetter, M. E., & Hughes, M. T. (2011). Computer assisted instruction to promote comprehension in students with learning disabilities. *International Journal of Special Education, 26*(1), 88-100.

Triantafillou E., Pomportsis A., Demetriadis S., & Georgiadou E. (2004). The value of adaptivity based on cognitive style: An empirical study. *British Journal of Educational Technology, 35,* 95–106.

Triantafillou, E., Pomportsis, A., & Demetriadis, S. (2003). The design and the formative evaluation of an adaptive educational system based on cognitive styles. *Computers & Education, 41,* 87-103.

Tzouveli, P., Schmidt, A., Schneider, M., Symvonis, A., & Kollias, S. (2008). Adaptive reading assistance for the inclusion of students with dyslexia: The AGENT-DYSL approach. In *Proceedings of the 8th IEEE International Conference on Advanced Learning Technologies (ICALT 2008),* Santander, Cantabria, Spain.

UNESCO. (2000). *Analytical survey of information and communication technology in special education.* Moscow, UNESCO Institute for Information Technologies in Education (IITE).

Whirter, J., & Acar, N.V. (1985). *Çocukla İletişim. Öğrenme, destekleme ve çocuk yetiştirme sanatı.* Ankara: Nuve.

Wilson, A. J., Dehaene, S., Pinel, P., Revkin, S. K., Cohen, L., & Cohen, D. (2006). Principles underlying the design of "The Number Race", an adaptive computer game for remediation of dyscalculia. *Behavioral and Brain Functions, 2,* 1-14.

Witkin, B. R., & Altschuld, J. W. (1995). *Planning and conducting needs assessments: A practical guide.* Thousand Oaks, CA: Sage Publications, Inc.

Yigiter, S. (2005). *Sınıf öğretmenlerinin özel öğrenme güçlüğüne ilişkin bilgi düzeyleri ile özel öğrenme güçlüğü olan çocukların kaynaştırılmasına yönelik tutumları arasındaki ilişkinin incelenmesi.* Unpublished master's thesis, Marmara University, Istanbul.

Zhang, Y. (2000). Technology and the writing skills of students with learning disabilities. *Journal of Research on Computing in Education, 32* (4), 467-478.