Evaluation of the Android Software for Special Needs Children

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ABSTRACT

It is clearly understood that technology oriented education on special training is neither sound nor adequate when considered from the literary point of view in our country. Limited studies held in country not only support this point of view but also demonstrate the lack of resource and studies carried out in this area. During the designing and developing process one of the qualitative methods called the design base research but then completing the design and development process, a common academic way of evaluation the single subject research method have been implemented in order to test the forcibleness of the work in the respect of special training and education. The study carried out through nine special training tutors and ten mentally disabled students. The following as a pilot study, the efficiency process has been accomplished through three teachers and three students. The feedback forms used to get the remarks of the teachers and through the use of the content analysis method the data resolved, during the phase of evaluation of the software. In respect of the analyses carried out, the practice has been considered as rather effective and applicable and useful by the teachers attended this pilot case study. The process confirming the results of the case study carried out by the teachers, according to the afore stated study, the results have been successful and the targeted notions have also been learned, which made the students feel that all these practices worked! It could easily be said that the software developed is both useful and applicable, moreover, the trainings committed conveniently have rather been effective.

Keywords: design based research, special education and technology usage, tablet computer, concept teaching, mental disability

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State of the literature

- Tablet PC's have recently started to be used as an education material for disabled individuals and the studies are continued to be conducted accordingly
- The use of different materials in the education of students with mental disorders makes the education be easier as well as contribute to the permanence of information
- When the materials or technological tools to be developed for the individuals who need special education are at the appropriate nature and level for such people, the personal and academic development of such individuals would benefit accordingly

Contribution of this paper to the literature

- As the vital aspects after the development of application, the teaching software to be developed for the individuals in need of special education should be simple and clear; the objects used should have the images of real objects; and the objects, which the students are familiar with and they have, should be used
- In terms of interface design, the full screen menu model should be used, and the pop-up menus or going to other pages' functions should not be considered
- The audio-visual incentive reinforcements should be used on the students to enable them to interact with the object that they touch on the tablet computer

INTRODUCTION

The majority of increasingly developing technologies are developed towards the individuals either without any disabilities or without any developmental disorder, yet such technologies may be insufficient for the disabled individuals that benefit from these opportunities for a limited level (Avcıoğlu, 2012). Considering that the disabled people live more difficult lives that the people without any disabilities, such challenges should be minimized. One of the groups that require special education is the people with mental disabilities. People with mental disabilities show a clear retardation from their peers from academic, social, language and self-care aspects (Avcıoğlu, 2012). In consideration with 15% of significant disabled population around the world (World Health organization and The World bank, 2016), the level of impact and benefit of the technologies developed for disabled people is well known. The assistive technologies to overcome the learning problems of individuals with mental disabilities have major advantages (Avcıoğlu, 2012).

One of the main problems of students with mental disabilities is to learn late and forget very quickly (Öztürk, Akkan, Büyüksevindik, Kaplan, 2016). The use of audio-visual tools and materials during the learning and teaching process enrich the learning environment, materialize the things to be learnt and make the knowledge be more permanent and logical for the students (Yanpar, 2008). Therefore, the permanence of learning and knowledge will be better among individuals with mental disabilities when various materials are used and such materials appeal to as many sense as possible.

Generally the learning disabilities among the students with mental disabilities are caused by the various difficulties during the information processing, and such students may have problems with the issues like reading, writing and mathematics. The visual processing, auditory perception or memory is indicated as the origins of these problems under the studies conducted in this field (Lopresti, Bodine and Lewis, 2008). These students may be considered as they are more in need to technology when compared with the regular students. The limited number of books and materials used for the education of these children are supported with technology and the attention of students are attracted more through using audio-visual and interactive materials.

Tablet PC's have recently started to be used as an education material for disabled individuals and the studies are still continued to be conducted accordingly. For the effective use the Tablet PC's in the education of disabled students, the education software should be strictly prepared and designed in accordance with the characteristics of children (Kose, 2009, Choi & Chan, 2015). As a main difference in such applications when compared with the content and materials developed for the regular individuals that are all colourful and attarctive, the content is simple, clear and the information wanted to be taught or transmitted is provided in the most simple way, there are no visuals that may cause information confusion and the environment is prepared for the interaction of child when learning (Fien, Doabler, Nelson, Kosty, Clarke & Baker, 2016; Kagohara, Meer, Ramdoss, O'Reilly, Lancioni, Davis, Rispoli, Lang, Marschik, Sutherland, Green & Sigafoos, 2013; Chen, Lee, Lin, 2016). Otherwise, according to the researchers, the cognitive load may happen due to the simultaneous use of many materials as given in the redundancy principle of multimedia principles (Mayer, 2001). Additionally, Tekinarslan (2012) emphasizes that the individuals with mental disabilities have problems in learning and using the information in the environments when many stimulant are provided at the same time.

One of the most and priority subjects found in the curriculum of children with mental disabilities is the concept teaching. The concepts have a significant place in the academic development of mentally disabled children since the concepts are similar in terms of their main features, yet their details facilitate to distinguish different objects or events, and create a systematic clustering (Tuncer and Altunay, 2012). A number of visual materials are used in the concept teaching. The use of different materials in the education of students with mental disorders makes the education be more easier as well as contribute to the permanence of information (Hwang, Su, Huang & Dong, 2009; Bakker, Heuvel-Panhuizen, & Robitzsch, 2016).

The insufficient use of technological devices in the special education centers located in Turkey and TRNC, and in mainstreaming can be considered as a big shortcoming under the current circumstances (Chen et.al, 2016). When the materials or technological tools to be developed for the individuals who need special education are at the appropriate nature and level for such people, the personal and academic development of such individuals would benefit accordingly. From this perspective, the best education service should be provided to

these individuals and ensure that they benefit these opportunities by use the advantages of technology at the maximum level. For this reason, the problem of this study is the lack of Turkish educational software in tablet computers supporting the development of concept skills of students with mental disabilities.

Aim

The aim of this research is to develop software for the use of teachers and students in the concept teaching to the students with mental disabilities by using a design based research method based on the dual coding and operant conditioning theories.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Dual Coding Theory

Dual Coding Theory that provides a theoretical framework to the multimedia designs is based on the hypothesis that the coding of same information in the different ways supporting each other would increase the effectiveness and efficiency in learning (Paivio, 1986). A number of studies conducted on the similar domains also indicated that the multimedia designed on the basis of dual coding has a significant impact on the academic success (Aldağ and Sezgin, 2005). Established by Paivio, this theory defines the processing, coding and remembering the information based on the structural and functional features of verbal and non-verbal coding. When the verbal content is provided together with the visual content, the learning becomes more effective and efficient (Olcay & Gul, 2016). From the perspective of individuals who need special education, the one of the significant advantages of multimedia materials is as since they can be personalized, they can be designed in accordance with the characteristics of individuals, who develop different than other individuals (Chen et. al, 2016; Choi & Chan, 2015). Therefore, the importance of mobile devices and educational applications developed for these devices stands forward in terms of the use of personalized teaching applications (Sweller, 2005).

Operant Conditioning Theory of Skinner and Concept Learning

According to Skinner (1953), the behaviours are controlled by the results of stimulants rather than the stimulants themselves, and such behaviour is defined as the operant behaviour. The operant behaviour is realized due to the reaction of surrounding as the result of behaviour (Lesgold, 2001). An appealing or non-appealing situation arises in consequence of behaviour. This is a determinant in learning. The behaviours bringing a prize and protecting from penalty are repeated and the ones causing a penalty is faded (Erden and Akman, 2002). The learning after this process is explained by the operant conditioning (Fer, 2011, p. 22).

As a result of his research, Skinner noted that the learning is the changes in the behaviours. The operant conditioning theory is one of the most used theories in the application environments and that is within the behavioural approach. The main hypotheses

of operant conditioning theory are as follows. (Alberto & Troutman, 2012; Tekin-İftar, Kırcaali-İftar, 2012).

MATERIALS AND METHOD

A qualitative research method and design based model are used for this study. Between subject multiple probe model, one of the single-subject research model is used for effectiveness identification of developed software is used.

The design based research model is a research process conducted in order to design new applications such as educational software or new theories that will affect the learning and teaching (Merriam & Tisdell, 2016; Brown, 1992). Single-subject researches can separately evaluate the impacts of independent variable on the dependent variable through the measurements repeated under the standard conditions (Tekin-İftar, 2013). For a study to be conducted in the field of special needs; reaching a foreseen number of participants or ensuring a homogenous research group may be challenging (Tekin-İftar, 2013). This study uses the single-subject research model since it would bring the most efficient results (Alberto & Troutman, 2012).

Participants

The research had undergone an eight-month development period and 10 students from different disability groups had participated. Out of the selected students, 8 of them are from the two public special education centres located in Nicosia and Famagusta districts of TRNC, and 2 of them study in the inclusive class, together with the teachers. The details regarding the students included to the research are given in Table 1.

Table 2: *The details regarding the students included to the research.*

Participant (Teacher)	Participant (Student)	Gender	Age	Disability
	Student 1	Boy	5	Autism
	Student 2	Girl	5	Down Syndrome
Teacher 1	Student 3	Girl	5	Down Syndrome
	Student 4	Boy	5	Autism
Teacher 2	Student 5	Boy	11	Mild Mental Disabled
	Student 5	Girl	7	Down Syndrome
	Student 6	Boy	8	Down Syndrome
Teacher 3	Student 7	Boy	11	Otizm

Teacher 4	Student 8	Boy	12	Mild Mental Disabled
	Student 9	Girl	8	Autism
Teacher 5	Student 10	Boy	8	Mild Mental Disabled

Then, in order to identify the effectiveness of developed software, a pilot activity was performed with Student 1, Student 2 and Student 3. The participants are chosen in compliance with the sampling method and the study was conducted with the students, who do not know the concept issues within the software with the capability of learning.

Prior to the pilot activities, the teachers were informed regarding the tablet computer, use of software, pilot working period and points to consider. Pursuant to the meetings conducted, the concept of "Less" is determined among the concepts in the software.

Data Collection and Analysis

The reactions, right or wrong answers of students during the processes of application undertaken by all teachers were observed and recorded. The observations were made by the researcher on the time of application and recorded with the video recorder after taking the consent of families. Therefore, all behaviors of students and challenges during the teaching and reactions were recorded and analyzed. The success levels of students towards the subject taught were collected through the reporting module in the tablet pc, and analyzed whether the students had learnt the subject aimed to be taught.

During the study, no individual teaching was provided through the concept world software. Therefore, the interaction between the teacher and student kept higher and in case of any lack of attention or behavioral problem, it was instantly interfered and the student brought back to the lesson.

As a result of all teaching activities, 56 teaching data in total and 32 examination data were collection. Correspondingly, the researcher together with a special education teacher watched 63 videos, and the performances of students were identified. Linear graphic as one of the most used graphic analysis methods in the single-subject researches was used for the analysis and demonstration of all performance data.

Developed Software

For the software developed for concept teaching, simultaneous prompting method was decided as the teaching method. As a result of need analysis, it was decided to design materials related with the concept subjects. The selected concept subjects were; Big, Small, Long, Short, Less and More. A total of 180 teaching and 180 evaluation pages were designed for all six concepts, and the objects used in the pages were prepared together with the

teachers. After the development of software, 6 instructional technologies and 6 special education experts were consulted. Following the consultation, a reporting module recording the right and wrong answers was added. For the effectiveness trial, the developed software then evaluated through a pilot activity conducted with three students. The application was developed with Adobe Flash Professional program and Action Script 3.0 software language in the manner that will work in all Android devices.

During the development of software, the aim was to transfer the traditional concept teaching of teachers in the same way to the tablet computer. In this perspective, the "Concept Teaching" by Vuran and Çelik (2012) used as a reference book for the concept teaching in special education in the universities at the bachelor's level was used as another reference book for the development of draft software.

The functioning and main structure of developed software is as follows.

The modules can be reached via the home page. The modules in the software are teaching, evaluation, report, help and contact modules. The name of software is decided as Concept World. The application can be found in Google Play with the keyword of "Kavram Dünyası" in Turkish language.
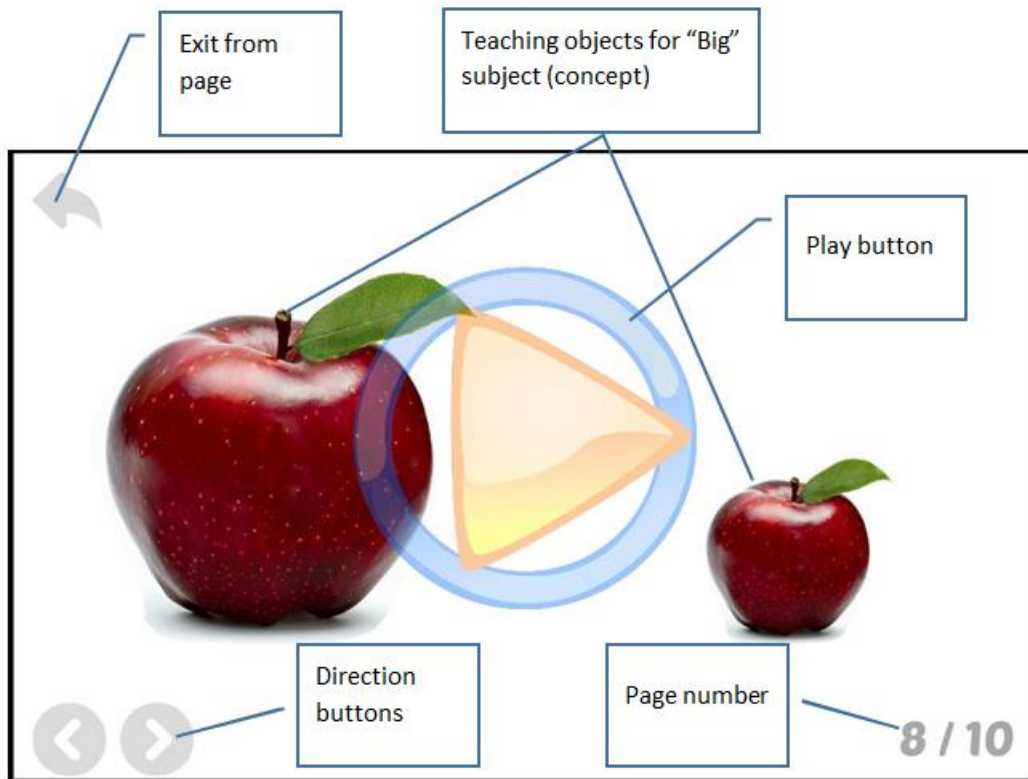
Figure 1: *Screenshot of teaching module with theoretical framework.*

As seen in Figure 1, there are ten different teaching pages (objects) when entered into the software (Teaching Module). When the teacher/student touches on the play button, an image of finger comes and asks, "Which one is big? Show". (Figure 2). For making the material more effective, the dual coding theory was taken as a material and the audio and visuals were used together.
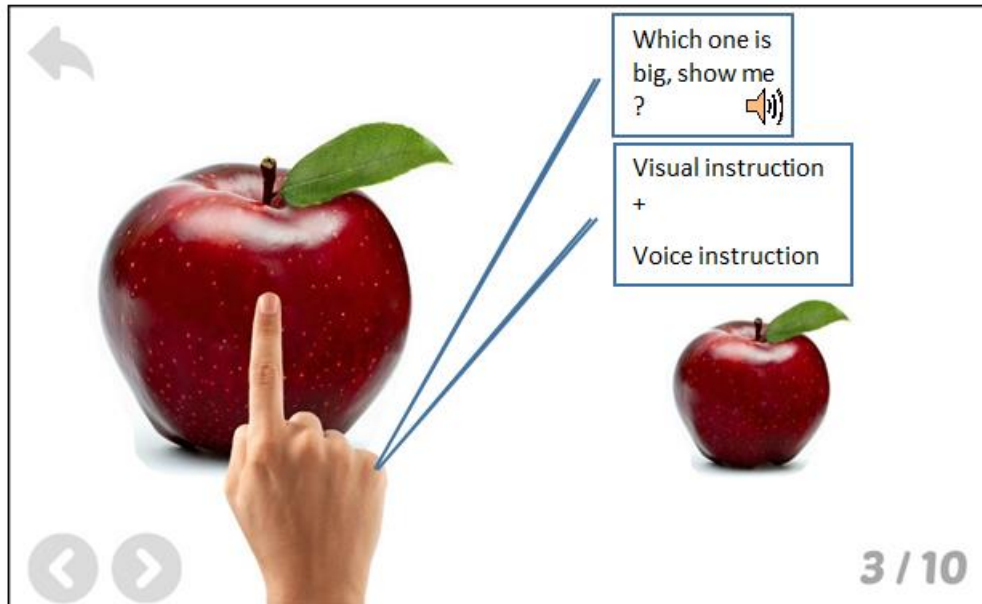
Figure 2: *Screenshot of teaching module with visual and voice instructions.*

When the student touches the correct answer, as a visual, reinforcement pops and at the same time, some verbal reinforcements like well done, correct; congratulations, you're great, good answer appear (Figure 3). Therefore when student answers correctly, the learning is ensured through audio-visual reinforcements. In case of an incorrect answer, there is no feedback. The theoretical background used at this point is the operant conditioning of Skinner. It would ensure that the student reacts through constant correct answers. This method is used in the concept teaching for mentally disabled individuals and called errorless teaching method (Tekin-İftar, 2013).
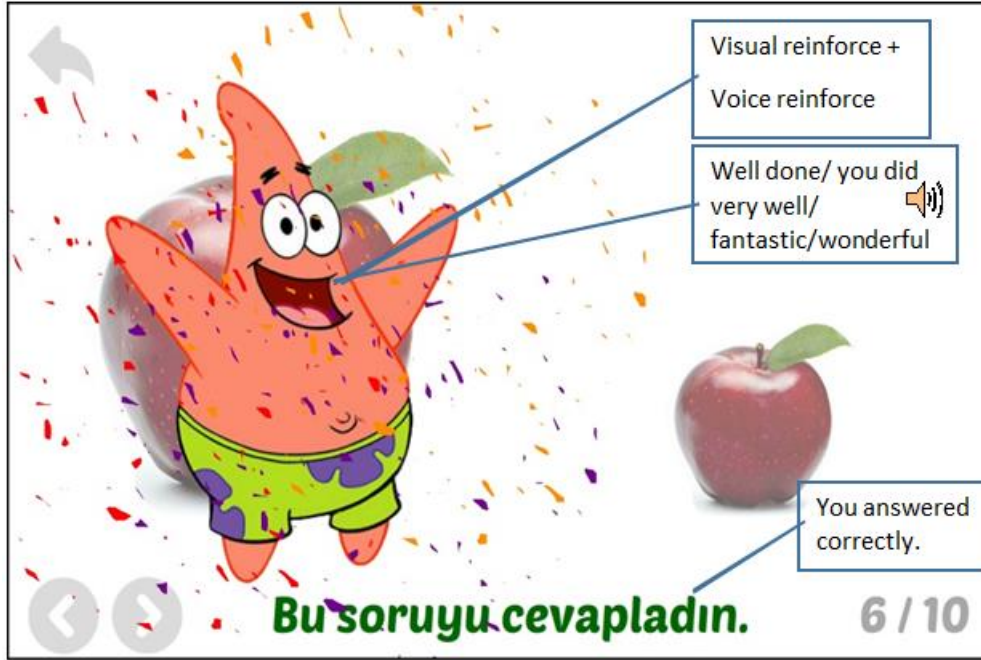
Figure 3: *Screenshot of teaching module with visual and voice reinforce.*

An evaluation module is also added for evaluating the teaching activities. The same methods are used within the scope of this module but the evaluation is performed with completely different objects. The student is only given an instruction, question and expected to show the correct answer. All correct and incorrect answers of students can be tracked via the reporting module in accordance with the date of activity and name of student. The reporting module saves all data of students in the database separately for each student.

RESULTS

The performance data of students indicating the level of performance of students for the target skill is calculated as percentage and shown on the coordinate plane (y) between 0-100. X-axis shows the start level, examination and teaching sessions. Each dot on the graph means a session.

In accordance with the findings of study, Student 1 completed the teaching activities on eighteen sessions. At the end of eighteen sessions, Student 1 was observed as completing the instructions within the software without any help from his/her teacher and any hints. Student 2 and Student 3 also learnt the targeted concept at the end of process. The information regarding these processes is elaborated below.
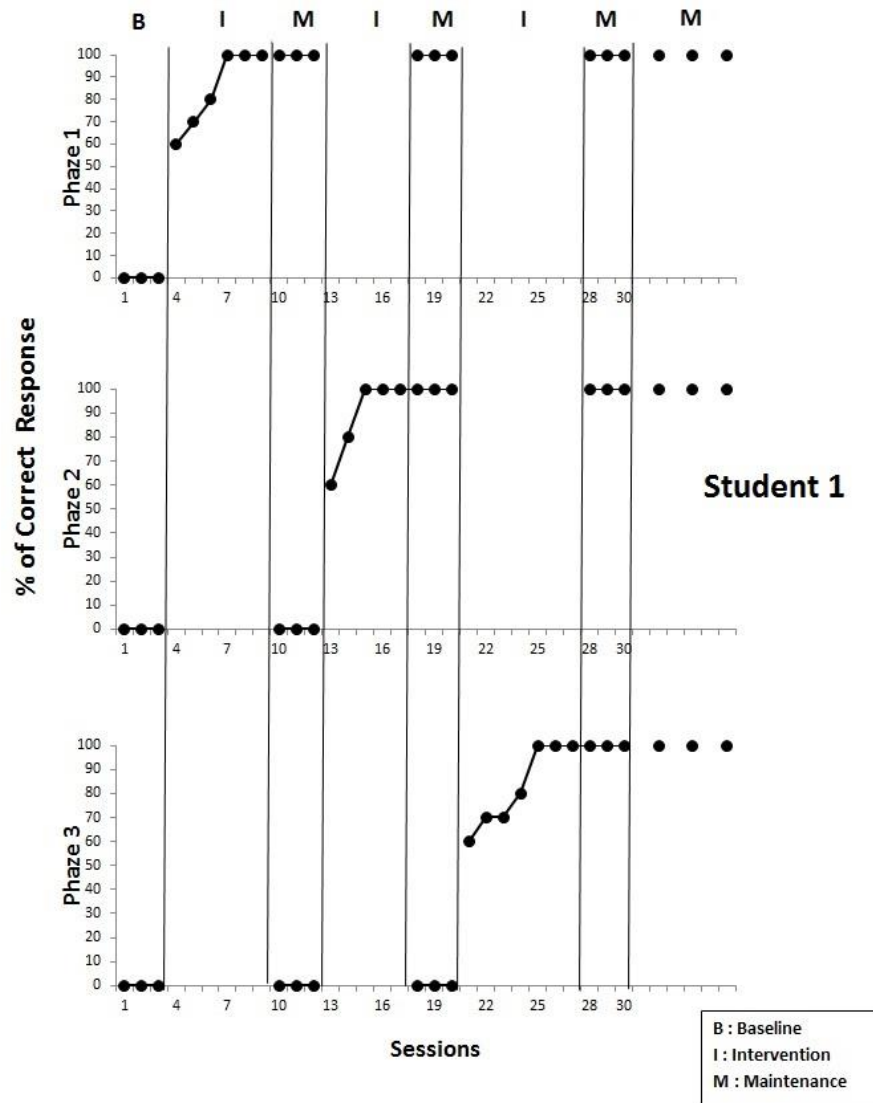
Figure 4: *Data Graph On the Success of Student 1.*

Following the completion of Student 1 teaching activities and a successful performance in learning the concept, the examination data were collected again with Student 2 and Student 3. After the collection of data from these students, the teaching activity with Student 2 was started as decided before. As seen from Figure 33, Student 2 finalized the teaching activities after twenty sessions.
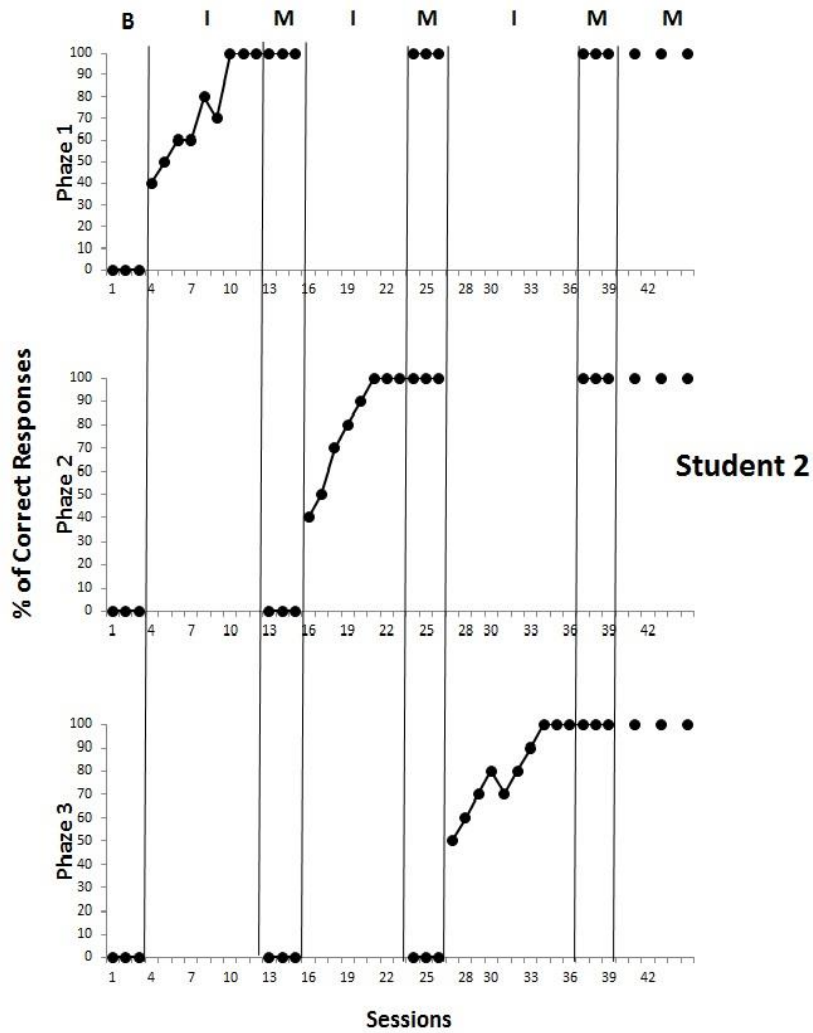
Figure 5: *Data Graph On the Success of Student 2.*

After completing the teaching activities with Student 2, the examination data were collected for all students. As a consequence of these data, the teaching activity started with Student 3. Student 3 completed the activity after 22 sessions and learnt the targeted concept.
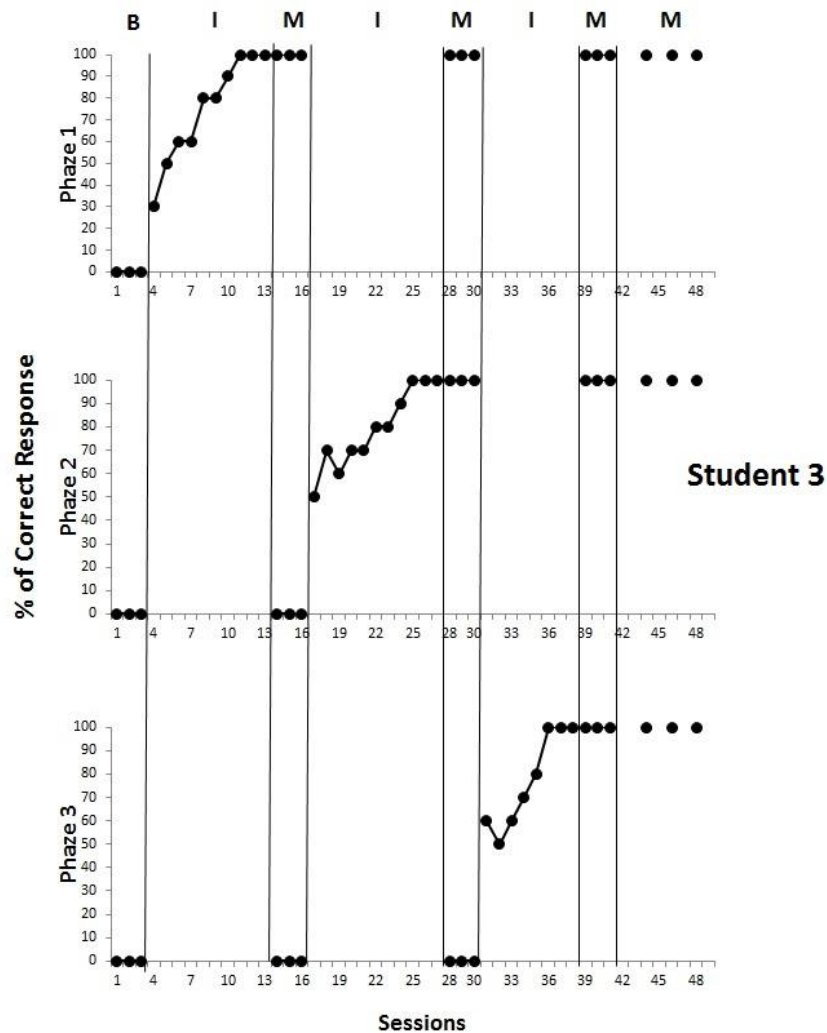
Figure 6: *Data Graph On the Success of Student.*

After the finalization of teaching activities for all students, a two-week break was given and the examination sessions were held with the students.

The graphs indicate that all students with mental disabilities that were taught within the scope of this study have very low performances regarding knowing the concept of less, then they learnt the concept through the software by 100%. In accordance with the data, it was found that all students did not know the concept of "less" as one of the concept subjects and the teaching activities was launched with Student 1. After nine sessions, Student 1 showed an improvement in terms of performance and managed to define the concept of less independently. Therefore, the teaching activity conducted with Student 1 can be considered as effective. When Student 1 reached to a sufficient level of performance, the examination session was held with other two students. As expected, the other two students did not know

the concept other than Student 1. Thus, it can be indicated that only Student 1 showed an improvement in terms of performance.

In the following process, the applications continued with Student 2 and Student 3 respectively. As seen in the student success graphs, the performances of both students had shown a significant improvement for the concept of "less" after the teaching sessions and they had reached either to 100% or closer to this performance. Additionally, the students that learnt the concept of less in all teaching sessions showed a similar success during the examination process, which indicates that the taught concept was learnt permanently.

DISCUSSION AND CONCLUSION

A Within the scope of this study, a design based research method was used and a mobile application towards improving the concept skills of individuals with mental disabilities was developed. The effectiveness of this application was then evaluated through using a single-subject research method in a pilot activity.

The teachers gave positive feedback about the application from the aspects of its context design, interface design, ease of use and content, and thus the application was considered as practicable and useful in general. In the studies conducted to evaluate the usability and effectiveness of application developed via a design-based research, Çankaya (2013) precipitated that the developed software is easy to use and has an effective design. During the effectiveness activities of software, the conclusion was that the targeted skills were taught in a successful way and the performances of students had improved. As a result of conducted study, the design based research method was found effective.

As the vital aspects after the development of application, the teaching software to be developed for the individuals in need of special education should be simple and clear; the objects used should have the images of real objects; and the objects, which the students are familiar with and they have, should be used. In terms of interface design, the full screen menu model should be used, and the pop-up menus or going to other pages functions should not be considered. In case of any consecutive objects, such content should be provided intricately and no specific order should be followed so that the tendency to answer from memorizing is eliminated among the students. The audio-visual incentive reinforcements should be used on the students in order to enable them to interact with the object that they touch on the tablet computer. It has been concluded that the more concentration that a student has for the context in the tablet computer, the better will be the teaching. Moreover, all elements that are aimed for teaching, i.e. buttons, should not be in the color or features that would distract the student.

The developed application was tried through a pilot activity and the teachers as the users of application were asked for their comments regarding the application. The teachers

were subjected to an assessment from the aspects of design, ease to use and efficiency of the application. In accordance with the pilot activity, the three students, who participated to the pilot activity, learnt the concept aimed for teaching. The teaching activities conducted by teachers were efficient and the students were benefited from the training provided through the tablet computer and they are happy. As a result, the developed software is considered as an effective teaching material and can be effectively used in the concept teaching activities for the individuals with special needs. Cankaya (2013) also reached to the same outcomes. Within the framework of this study, a mobile skill teaching software was developed for the use of family members and individuals with mental disabilities in order to teach daily life skills to the individuals with mental disabilities between the ages of 16-22, and the effectiveness of this study was assessed. In consideration with the research outcomes, the teaching activities using tablet computers are effective and the students are able to learn the targeted skill.

Eliçin and Tunalı (2016) had reached efficient results in their study performed on the effectiveness of tablet computer use in achievement of schedule-following skills by children with autism- another study supporting the results of this study- and they concluded that on the acquisition of target skills, follow-up and generalization among the subjects, the graduated guidance teaching provided with tablet computers was completed in an effective way.

Although there are various studies conducted in foreign literature concerning the integration of tablet computers into education environments, there is not any study conducted in our country in Turkish language. Some of the education institutions had integrated and started to use tablet computers under their institutions. However, the results of need analysis showed the lack of contents and challenges in using these tools. The development of this software has contributed into this shortcoming and hopefully it will guide the future studies.

As seen in the results of sentiment analysis conducted during the teaching, the students were confused in the beginning when they had interacted with the tablet computer for the first time and then after a short while they had adapted themselves to the tablet computer and developed software, which had direct impact on the happiness of student. From this perspective, there is a good relation between the tablet computers and individuals with mental disabilities, and the students have a positive motivation and attitude towards these devices. Regardless the material used in the teaching process, it is certain that there is a significant relation between the satisfaction of student and the material used in teaching. This has a major impact on the success of student, which also indicated in the researches. There are studies in the literature, which were conducted on the tablet computers towards the motivation and attitude of students, yet these studies only presents the views of teachers (Chen et. al, 2016). In order to be more realistic, this study had reached the results through refined reality and sentiment analysis.

As in every study, this study also has limitation. This application only covers the subject of "concept". The future studies may analyse the effectiveness of other subjects.

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