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Children Usability Evaluation for the
E-Learning System for Children outside the Schools in Sudan

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ABSTRACT
This paper aims to show the results of an evaluation of an E-learning System designed for children outside school in Sudan. The main objectives of the research were to explore Human Computer Interaction (HCI) evaluation techniques, design and evaluation tests to evaluate the learnability and attractiveness of The E-Learning System (ELS) among children. This effort aim s to provide feedback to ELS designer and provide a basis for future ELS interaction evaluation. As the ELS project was not yet programmed we developed prototypeWe developed five tests: usability, learnability, attractiveness, interviews about design objects and mouse interaction to measure the interaction of children with ELS in Sudan. The methods used were: co-discovery, peer tutoring, direct observation and interview method. The evaluation was conducted in the real environment in Gadref State in Wad Elmshamer village with 22 children. The results showed children preferences in colors and illustrated differences between boys and girls in the interaction with mouse and the exercises. The results showed the children dealt more comfortable with being observed with being interviewed method. The research recommended: minimizes the target and drag process in the project design, use more of the shine color, consider differences between boys and girls and recommended more studies about the project of E-learning and their benefits.
Keywords :— E-learning, children, Sudan, Evaluation.

I.   INTRODUCTION

The E-Learning System (ELS) for children outside the school designed for 100,000 children out of school. The target age for children 6-9 years old who have missed the first chance of enrolling in schools and provides them with access to a short 6-month to 2-year catch-up program through e-learning focusing on numeracy and basic literacy skills to enable their re-integration into the formal primary school system.

The research takes into account Human Computer Interaction (HCI) concepts. Human-computer interaction is the study of how people design, implement, evaluate and use interactive computer systems and how computers affect individuals, organizations, and society.

II.   REVIEW

E-learning "is commonly referred to the intentional use of networked information and communications technology in teaching and learning. A number of other terms are also used to describe this mode of teaching and learning"[1]. They include online learning, virtual learning, distributed learning, network and web-based learning[1]."Fundamentally, they all refer to educational processes that utilize information and communications technology to mediate asynchronous as well as synchronous learning and teaching activities"[1]. E-learning is a means of education that incorporates self-motivation, communication, efficiency, and technology[2].

Children are becoming basic users of software and technology [3]. The children's technology often has goals such as education or practice, keeping the user engaged and interested is an important goal[3].

There is a wide range of children using the internet especially for education, when designing for children must narrow the age group[4].

The interfaces should be primarily visual, and text materials should be presented in an age-appropriate format. The mouse interactions such as selection, targeting, and dragging should be simplified because the children's fine motor skills are not fully developed. The designs must take into account the differences between boys and girls[3].

The child learning can be more effective with considerations are take into account such as Children want to learn and they have previous experience and insights in mind, Children need to learn information that is relevant and learning needs to be related to a child's environment and Children love to play and playing is an active form of learning[5].

Evaluation of e-learning, learning and training programs has become a widely researched area. This is due to the fact that the performance of learners and education itself is vital to enabling learners to reach their full potential[2]. We can get early feedback by building prototype and do usability evaluation. The usability evaluation can be done using many methods such as: thinking aloud, co-discovery, formal experiment and query techniques[6].

E-learning technologies have the potential to rescue the isolated and underprivileged students from their loneliness

and improve the effectiveness of learning[7].Educational computer systems are important because they allow a number of possibilities that are hard or impossible to achieve in other ways of teaching[8]. The problem of the children outside the school in Sudan cannot be solved by traditional means due to the cultural, geographic and socio-economic background of children[9]. The learning systems must take into account the differences in ages, gender and culture[10]. E-learning is beneficial to education, corporations and to all types of learners. Flexibility is a major benefit of e-learning. E-learning has the advantage of taking the class anytime anywhere. Students like e-learning because it accommodates different types of learning styles, E-learning helps students develop knowledge of the Internet [2].

The design which takes into account the human factors led to acceptance of product, and the usability is important for product success[11]. The system quality depends on using of the system by the user, so the Human-Computer Interaction must be taken into account[12]. It is important to think about who is a user, also there are other users such as the people who manage the users. The users must involve in the design process[13]. There are many reasons to ask the children about their opinions on the interactive products, the first reason is adults and children world is different so adults may be cannot able to understand what children want. The second reason is there is a new direction to include the children in the decision about their special environment, this arises from the great awareness that children are participants and actors rather than an onlooker in society. The third reason is to talk with children about their interactive technology, some people may have great motivation to include the children in design and evaluation of their things that are very important for children and useful for the researchers and developer[14].The research about the efficiency of the different methods of survey for children is rarely particularly when we ask the children to contribute with their opinion[14].

III.   TOOLS USED IN THE TESTS

The researcher design prototype because when we started the tests the project was not developed yet, the prototype in math about the lesson of 12 number, the researcher design the prototype using PowerPoint, and then used the following methods in the tests:

- Using the method of co-discovery in the first test through make a group of children (four children, for example) using the program together and arguing with each other in how to use it with the observation of their work.
- Using the method of Peer-Tutoring: in the second test by bringing two children from the former group and left them to teach other children how to use the program with the observation of their work.
- Using the direct observation to observe the work of children in the first, second, third and fifth test

- Using questionnaire to register the observer (facilitator) notes.
- Using in the fourth test an interview method with children to obtain the opinions of children about the design. After gathering information the researcher used SPSS (Statistical Package for Social Sciences) program to analyse the data

Fig. 1   Picture from prototype

IV.   DESIGN OF EVALUATION

The evaluation involves five tests which cover several points. The researcher designed the five tests to answer the research questions and in every test must register the gender and age of the respondent.

First and second test to assess the ease of use of design in first test use co-discovery method while in the second test use peer tutoring method. The first and second test contains three questions about the deal of children with the design such as the deal with move to the next page through the arrows.

The third test is registration of how many times the children used the program during four days which these days are separated, this to assess the children angagement.

The fourth test is based on interviews with children about their opinions on design objects such as the pictures, colors, font sizes, animations, and other components.

The fifth test is observations of children interaction with mouse in the prototype, and exercise about the lesson.

Also the researcher design questionnaire for the observer to register their notes about:

1. How children deal with the observation.
2. How children deal with the interview.

V. THE AREA AND CHILDREN

The pre-test done by the researcher in Ahfad university with a sample of children from Gadref state (real users)in a closed door area. The actual test applied in Gadref State in Wad Elmshamer village because it was the real environment of the ELS. The sample includes all 22 children (11 boys and 11 girls) involved in the project in the target age (710 years old), and the facilitator was a familiar person to the children and that contributed to good results because it decreased anxiety.

VI.   THE RESULTS AND DISCUSSION

The results of the first test showed that the children learned to use the program is easily The second test supports this finding and the answers to the questions show that the children have computer skills, and the researchers noted this in the pre-test. In the second test, the researchers noted the positive progress in the percentage of the answers from the

first test so we can say the program is easy to remember in addition to easy to learn.

The children, in addition to learning to read and write they will learn to interact with computer systems and learn the basic computer skills. The researchers note in the pre-tests that children have good computer skills e.g .they can deal with files, they can save files, they can write their names, and they can read the characters of the keyboard in Arabic and English. These children came from a village environment, and they are young so the authors think this shows good progress.

The children in general prefer shine colors, and there is no big difference between girls and boys. Also, the result shows that the colors used in the program are acceptable colors for them especially the red color. there question "are you want replace the picture of boy in the program by picture of girl" all most the children select boy picture and just two girls select the picture of girl and the author think this due to the culture in this area is rural area.

The researchers think the program is attractive for children:

- In the third test i was shown that although the time duration of using the program was decreased all the children used the program during the last day.
- In the interviews, 100% of children say the picture, colors, font size and all program are good.
- In the interviews, 100% of children say they prefer to learn through the computer rather than with the text book.
- In the interviews, 100% of children prefer the computer to the toys.
- In the interviews, almost all of the children say the colors does not need change, and all the children say the program is good and that no things need to change.

The results in the fifth test shows that the performance of boys in the exercise (exercise in mathematics addition operations) is better than girls (36.4% of girls obtained full mark while 63.6% of boys obtain full mark) and the performance of old children is better than the youngest children.

The result of question three in fifth test shows that:
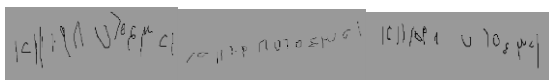

Fig. 2   Writing with mouse – girl's sample

Fig. 1   Writing with mouse – boys sample

- 45.5% of children draw the numbers(1-12) using the mouse in discreet manner and this result because the children's fine motor skills are not fully developed.
- We note when the age increase the ability to use the mouse increase.
- The girls use the mouse better than boys (72.7% of girls draw number using mouse

in continues manner while just 36.4% of boys draw number using mouse in continues manner).

In the first test the researcher used the co-discovery method which let the children corporate together in the system Co-discovery intends to let the users collaborate with each other to learn how to interact with the system[15]. This method is supposed to facilitate discussion between the subjects and provide information on their understanding of the interaction[15]. In the second test, the researcher used the peer tutoring method which can introduce additional information such as the ease of remembering. In the Peer Tutoring method, children teach their friends how to use the technology after they have interacted with the product. This technique is useful to see how children have understood the product[15]. The observer note in two methods that the children act together in natural ways. Arguably, this is because the observer is familiar to the children. The children also aren't confounded during observation. However the results showed that 90.9% of the children quite during the interview while 93.8% of the children quite during the observation.

The interviews show that just 36.4% of children think before answering. The authors think it is not bad percentage because the questioning during interviews are direct and the children thus need not

long to think. Also short questions and the concept of an interview new to the children. Over time this results will improve, and the nature of children will help. The interviewer thinks that the answers of the children are true. The authors think that is referring to: the nature of children, the simple and direct questions and the interviewer are familiar to the children. We may note that in regard to the interviews that most of children give short answers, we think this is due to the nature of questions also being short, or maybe this result indicate that the children were uncomfortable with the interview situation.

VII.   CONCLUSIONS

The project of E-learning is directed to the village environment so it will introduce progress in this environment and. The results of the evaluation show that the design is acceptable for the children and they gain good computer skills from the project. The results also show differences and similarities between the boys and girls. The differences between boys and girls appear in: solving the exercise the boys is better and in the mouse interaction the girl is better and this results may indicates there are differences between boys and girls in the mental process and in the fine motor skills. So this point needs further studies about these differences and their influence in the education process and how can it be considered in the design process. Based on the results we recommend:

(1) to minimize the target and drag process in the project design,

(2) use more of the red color in the design as it is liked by most children,

(3) do further studies on the differences between boys and girls, and the degree to which these differences may influence the education process

(4) and continue with studies of the project of E-learning to assess both the individual benefits as well asthe benefits to society.

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