An Arabic-Based Tutorial System for Children with Special Needs

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Abstract. In spite of the current advance of the use of computers in education in the Arab world, complete suites of solutions for students with special needs are very scarce. This paper presents an assistive system managing learning content for children with intellectual challenges. The system provides educational multimedia contents, inspired from the local environment, in different subjects such as math and science to target specific learning goals. The system tracks the individual student progress against the student individualized learning plan assigned by the teachers and according to their abilities. Upon completion of learning a particular task, the system will test the learner to order a set of sub-tasks in its logical sequence necessary to successfully accomplish the main task. The system also facilitates deploying intelligent tutoring algorithms to automatically correct mistakes after a number of trials working adaptively with the learner to successfully learn how to complete the task.

Keywords: Intellectual Disability, Computerized Learning, Educational Multimedia Contents, Personalized Learning.

1 Introduction

Since more than two decades, the use of computer as an assistive teaching tool shows a significant improvement in learning process especially for school children [1, 2]. Besides, with the continuous development of computer software and applications, it becomes attractive to use computers in teaching children with intellectual disabilities. This can be clearly seen through the possibility of teaching students according to their level of abilities and speed of interaction, providing a continuous feedback, and motivating them with interactive educational multimedia contents [3]. Indeed, lots of research studies [4, 5, 6] show the great benefit of using computer to effectively enhance the teaching process for such kind of children who require special and continuous training in order to facilitate their learning process [7]. In the State of Qatar, it is estimated to have more than 3% of children with some intellectual challenges. This percentage is higher in the MEAN region. The educational needs for such children should not be ignored considering the importance of building their skills and merging them into the society. Recently, in 2010, the population statistics in

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Qatar show that 1290 are suffering of speaking difficulties, 883 are suffering of hearing difficulties, 1284 are suffering of vision difficulties, and 1255 are suffering of memory difficulties. In the Arab world, despite the increasing attention given to the children with special needs, employing the computer in the educational process of such children is still limited due to the following reasons: First, there are little computer software that supports both Arabic language and culture. Second, most of the computer teaching tools are only relying on the rigid power point presentation. Third, software development companies do not effectively participate in providing high quality educational multimedia contents. Finally, if some software applications are available, ordinary people don't afford to buy it for their children. The state of Qatar shows a great concern towards improving the learning process for the children with special needs. They established recently the Shafallah center [8] as the leading center in Qatar provides such children with several services to educate them, build their personal skills, and eventually merge them in the community for better living. The center is now serving more than 450 children distributed into different teaching classes according to their intellectual abilities. The classes are made up of 7 to 8 children with 2 to 3 teachers who facilitate the learning process and monitor the children. Each child has one educational plan, called the personalized plan, which is matched to the teaching objectives that this child has to fulfill within a certain period of time usually set to one year. During this period, the child's progress will be monitored, evaluated, and the plan will be updated accordingly until the teaching plan objectives are achieved. The teachers are using power point presentations to deliver the lessons. Students assessment is currently done manually.

2 Proposed System

The importance of the system that we propose is to reduce the administrative and teaching overhead of the Shafallah center through automating the management procedures and involving the children's parents in the learning process.

2.1 System Architecture

The system supports and monitors the learning process through providing several interactive educational multimedia contents consisting of text, images, and short clips. These multimedia elements are linked to the objectives of teaching personalized plan. The system can provide dynamicity in offering its educational multimedia contents when considering children's level of abilities and speed of interaction. The system records the children progress to allows issuing reports. To accommodate the children difficulties in using the computer, the system provides each child with a PC tablet equipped with touch screen. The system can be used in two ways:

- *Group activities*: the system uses a smart board to view multimedia contents, i.e. lessons, puzzles, quizzes, etc. The children can interact with these contents.
- *Individual activities*: each child has his own tablet. The teacher controls the class by sending different multimedia contents to the children's tablets according to

their level of abilities and personalized teaching plan. The children are able to practice the contents at home as the teacher will daily transfer a copy of these contents to the children's tablets. A web-based application is being developed.

2.2 The Users of the System

The system has four types which are: *administrator*, *teacher*, *parent*, and *student*.

A. Administrator: it is the responsibility of the administrator to manage all users' accounts including adding deleting, and updating. He/she uploads the multimedia contents and the plans. He/She links these contents with their corresponding objectives. System settings like sending parents periodic SMS/Email for feedback on their children progress are also handled by the administrator.

B. Teacher: the learning process in the class is managed by the teacher who can control the educational multimedia contents to be viewed on the smart board as well as the students PC tablets. The teacher also transfers the daily covered contents of each student to his/her tablet for home revision with the parents.

C. Parent: the system effectively contributes in increasing the level of interaction between the parents and their children through: First, sending periodic short SMS and Emails about the children progress. Second, ability of accessing the system website to post feedbacks about their children personalized plan. Third, having the class materials installed on the children PC tablet gives the parent the opportunity to follow up with their children's daily classes. Finally, parents can review their children's daily lessons and contact teachers for any inquiries.

D. Student: this is the main user of the system who can smoothly interact with the contents available on both class smart board and PC tablet. Upon completion of a lesson, the system provides the student with several puzzles and games to evaluate his/her understanding of that lesson. This process is done with multiple trials, and intelligent algorithms are built to indicate student's mistakes. The system tracks all student results, record it in database and eventually reports the student performance.

2.3 The System Features

1. Provides several interactive multimedia contents (video, audio, image, text) inspired from the Qatari environment to achieve student learning objectives.
2. Provides principles of effective teaching by stimulating students through several multimedia educational games that encourage them for practicing required skills.
3. Supports individual learning style as it treats each student independently according to his/her personalized study plan and then monitor the performance individually.
4. Involves parents in the teaching process through the automatic delivery of SMS/Email and remote website access to track the students' performance and give feedback on their personalized plan.

5. Accelerates the teaching process by having the parents follow up with the students' daily classes installed on their PC tablet.
6. Reduces the administrative overhead on the teachers and save their time and effort in preparing assistive teaching tools.

3 Educational Content

The system provides a large number of contents to meet the objectives of the learning process for the children. These contents are designed and customized based on the international educational system FACE adopted by the center which cover different scopes including math, science, reading, writing, religion, and social life. The contents are divided according to both learning objectives and stages. This can facilitate the role of the teacher in matching personalized plan objectives with its associated contents. Each student is characterized independently based on his/her intellectual challenge. Then, a personalized study plan is prepared with long-term objectives to be achieved within a specific period of time. These objectives are, in turn, divided into short-term objectives to be served with well-designed multimedia contents that suit the student's abilities. The contents are designed with a focus on:

1. Inspired from the local Qatari environment such as dress, food, shops, currency.
2. Suites students' intellectual, vision, and hearing capabilities such as sounds/color clarity, and levels' difficulties.
3. Includes different types of knowledge such as social and functional knowledge.
4. Easily interacts with student to achieve the learning objectives of a the study plan.
5. Motivates students through using excitements contents apart from rigid teaching.
6. Varies in teaching styles i.e. match objects, drag and drop, and puzzles.
7. Features the ability to repeatedly updates, improves, and personalizes contents.
8. Organized and sequenced logically i.e. from basic to advanced.

4 Evaluation and Assessment

The evaluation and assessment process for children with special needs takes different aspects compared to those for normal children due to the limited capabilities of the first group. Here, we consider two main types: individual assessment and curriculum-based assessment. In individual assessment, children performance is monitored individually and differently according to their disability. This can help us in determining children weaknesses points and how it is related to their disabilities to eventually lead us towards designing their most effective educational contents. In the curriculum-based assessment the children performance is continuously evaluated against a predefined group study plan objectives and then the collected results are used to make comparisons and update existing teaching methods whenever necessary. Regardless of the assessment method adopted, the system will record children results in a specific database and generate reports accordingly. This can assist the teacher in choosing the next educational contents to be delivered for the children. Moreover, the system adopts a feedback mechanism to periodically improve the teaching process as

follows: Teaching Objectives → Educational Contents → Teaching Methods → Evaluation → Assessment → Improvement → Teaching Objectives. A practical teaching improvement is also achieved with the use of this system especially when we compare the traditional teaching method in [9], directly from teacher to student, with the newly adopted interactive method that fully includes both teacher and parents.

5 Conclusions

We proposed an assistive system that manages the learning content for children with intellectual challenges. The system provides educational multimedia content, inspired from the local environment, to target specific learning goals suitable for this group of children. The system tracks the individual student progress against his individualized learning plan assigned by the specialized teacher and automatically generates reports that will assist the teacher in updating the student's study plan.

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