

The Use of Technology in Raising Awareness:
An investigation into E-learning Systems for Helping
Children with Diabetes

دراسة حول استخدام التكنولوجيا في مجال التوعية:
التحقيق في أنظمة التعليم الإلكتروني لمساعدة أطفال مرضى السكري

By

Mona Ali Abdullah Hammad Al-Mansoori

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Dissertation Supervisor

Dr. Khaled Shaalan, BUiD, UAE.

Dr. Hissam Tawfik, Liverpool Hope University, UK.

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Title	The Use of Technology in Raising Awareness: An investigation into E-Learning Systems for Helping Children with Diabetes
Candidate	Mona Ali Abdullah Hammad Al-Mansoori
Supervisors	Dr. Khaled Shaalan, BUiD, UAE; Dr. Hissam Tawfik, Liverpool Hope University; UK.
Faculty	Faculty of Engineering and Information Technology.
Degree	MSc in Information Technology Management.

Abstract

Diabetes is a common and costly condition disease that is associated with significant morbidity and mortality. Recent studies have shown remarkable increases in diabetes during the last decade. This has attracted many researchers and doctors to invest in E-Learning area in order to contribute in many ways to help people who are suffering from diabetes and other diseases. However there is a relatively little work that shed the light on educating children compared with the increase in the incidences of this disease. This has motivated us to conduct this study aiming at helping children with diabetes disease to raise their awareness and help to control the accelerating rate of it. This paper presents an investigation into E-Learning systems and how it can help people with diabetes, especially when it comes to children who have lack of information and awareness about their disease. This research addresses children' needs expectations, and proposes a design of an E-Learning prototype that can raise their awareness and knowledge in order to help reduce the effects of this disease on children. This prototype design has been used in Abu Dhabi Government Kindergarten targeting children between 3 to 5 years old. The result of this prototype indicates the successful of using computers and programs as an E-Learning tool.

يعتبر مرض السكري مرضاً شائعاً ومكلف حيث يقترن به قسط كبير من معدل الحالات المرضية والوفيات ، وقد أظهرت الدراسات الحديثة زيادة ملحوظة في عدد مرضى السكري خلال العقد الماضي، مما اجتذب العديد من الباحثين والأطباء للاستثمار في مجال التعليم الإلكتروني من أجل المساهمة بشكل أكبر و بطرق عديدة لمساعدة الناس الذين يعانون من مرض السكري وأمراض أخرى، ومع ذلك فإن نسبة العمل الذي يسلط الضوء على تعليم الأطفال قليلة نسبياً مقارنة مع الزيادة في حالات الإصابة بهذا المرض، وهذا ما دفعنا لإجراء هذه الدراسة التي تهدف إلى مساعدة الأطفال الذين يعانون من مرض السكري وذلك برفع مستوى وعيهم ومساعدتهم، وكذلك للمساعدة على السيطرة وتقليل معدل تسارع هذا المرض، وتعرض هذه الورقة التحقيق في نظم التعليم الإلكتروني وكيف يمكن أن تساعد مرضى السكري، وخصوصاً عندما يتعلق الأمر بالأطفال الذين لديهم نقص المعلومات والتوعية حول المرض، بالإضافة إلى أن هذا البحث يتناول احتياجات الأطفال وتوقعاتهم، ويقترح تصميم نموذج أولي للتعليم الإلكتروني يمكن من زيادة وعيهم ومعارفهم مما سيساهم في الحد من آثار هذا المرض على الأطفال، تم تجريب هذا النموذج في رياض الأطفال الحكومية بمدينة أبوظبي، وأستهدف الأطفال ما بين ٣ إلى ٥ سنوات ، ونتائج هذا النموذج أشارت للنجاح في استخدام أجهزة الكمبيوتر والبرامج كأداة للتعليم الإلكتروني

Keywords: E-Learning – Game-base Learning – Diabetes – Preschooler.

Chapter 1

A Brief Study Overview

This chapter presents the aim and objectives, research questions, thesis structure and research methodology. Section 1 is an overview of the topic. Section 2 discusses the problem definition. Section 3 highlights the motivations that cycle this study. Section 4 presents the research questions. Section 5 is looking at the aim and objectives of this thesis. Section 6 describes methodologies that have been used in this research. Section 7 is looking at the thesis structure and what each chapter will be looking at. Section 8 concludes this chapter.

1.1. OVERVIEW

The technology revolutions affect all aspects of life mostly to make living style easier. The technologies were expected to have effects and impacts on health care procedures, work practices and treatment outcomes. The aim is to find out how technology can help the patients with diabetes to increase their awareness in efficient way in terms of time, effort, and cost.

1.2. PROBLEM DEFINITION

As a beginning study of diabetes between Liverpool Hope University, UK and BUiD, UAE to help people suffering of diabetes around the world, it was my pleasure to be a part of this study and make an entrance on this field by developing a system that can help the preschoolers to increase and level up their awareness of

diabetes. This system will help to spread awareness by game learning techniques among children, teachers, and parents.

Through this research acceptance of this system among children will be measured as well as the opening of their parents and teachers. Through the observation feedback and the interviews' outcomes, will be analyzed to figure some useful modifications that will helps making the right adjustment on the system prototype.

1.3. MOTIVATION

The motivation for this research study comes from the recent emphasis on healthy lifestyle. The limited researches in the area of wither educational information is contained and incorporated in game play strategies can be as a motivation also for this study. However, there are some personal reasons that driven the researcher to this study as well. The driven motivations of choosing this study are the following:

- The researcher has diabetes parents and that means that she might become diabetes or any of her children.
- The researcher country is UAE which is the second highest diabetes rate around the world which is about 20% of the UAE population.
- Diabetes disease is increasing especially among youth.

1.4. RESEARCH QUESTIONS

In order to control the numbers of diabetes and raise the awareness, the following research questions and sub-questions are to be investigated:

RQ1: How can technologies help people with diabetes?

RQ 2: What are the uses of E-Learning technology in raising diabetes awareness?

RQ 2.1: What is diabetes?

RQ 2.2: What are the traditional methods to educate patients with diabetes?

RQ 2.3: Where the technologies reach in this matter?

RQ2.4: What are the UAE status and efforts to help diabetes?

RQ3: What is the convenient design of E-Learning system to be used in helping people with diabetes?

RQ 3.1: Why Game-based learning?

RQ 3.1.1: What are the benefits of using GAME-BASED LEARNING?

RQ3.1.2: Challenges for using GAME-BASED LEARNING?

RQ 3.2: The best age to start awareness and E-Learning?

RQ 3.3: The suitability of such age?

RQ 3.4: what theories can be used in such system?

1.5. AIM AND OBJECTIVES

The aim of this research is to find a way to help people with diabetes and control the growing number of this disease. By achieving the following objectives:

- To conduct a survey of related work that has been done to help people with diabetes.
- To identify the best way to facilitate the communication among people with diabetes and their dependents.
- To provide knowledge and understanding of learners with diabetes in the foundation phase to other student and teachers.
- To identify the best age group to start with this help.

1.6. METHODOLOGY

The report aims to identify key issues and themes arising from the literature reviewed from different resources such as literature review, observation, interviews, software evaluation, and Internet search. The review comprises a meta-review that

is a review of literature reviews, and literature has been grouped in relevant categories according to selected themes or issues. Literature was sourced from keyword searches of electronic databases, key journals in the field and a general search of the internet.

1.7. THESIS' STRUCTURE

The structure of this thesis is consistent with determined objectives and research methodology and it is divided into 6 chapters.

Chapter 1 introduces an overall view of this study. It addresses the problem definition, the motivation, the aim and objectives of the work. Further this chapter presents what are the research questions, what kind of methodology will be used and finally the thesis framework.

Chapter 2 provides a theoretical background on the topics studied. It presents a survey on technologies for facilitating educating of patients with diabetes. It defines diabetes, the traditional ways and method of educating patient with diabetes and how can E-Learning help them. Next, it describes the situation of diabetes in United Arab Emirates and how they are dealing with this matter. The chapter ends with an overall view and evaluation of the e-learning means that can help the diabetes.

Chapter 3 starts with the scope of the study. Further the methods that have been used in collecting the data. Then it ends with overall conclusion.

Chapter 4 presents a proposed prototype of system for helping preschooler diabetes kids. First it discussed the reason why to use game-base learning procedures and the reason of choosing preschooler stage. Then it discusses the suitability of preschool for computer based learning and the theories that the prototype embrace. Description of the prototype stages and their findings of each stage then ends with an overall view of the chapter.

Chapter 5 presents the conclusion of this study along with future work and recommendations for the future possible extinsion.

Last section will be the references used in our research and the appendices.

1.8. SUMMARY

This chapter introduced the thesis. After a brief background, the research was justified and the research problem highlighted. Research questions and hypotheses were also introduced. The methodology was discussed and the thesis structure outlined.

A Survey on Technologies for Facilitating Educating of Patients with Diabetes

The chapter presents an overview of the history, technology, standards, and current and future applications of E-Learning systems. Section 1 is a general overview of diabetes disease, including the definition, types and youth. Section 2 is the traditional ways of educating people with diabetes. Section 3 where identifying the ways on how E-Learning systems can help patients with diabetes including the devices, multimedia, SMS to educate diabetes self-management. This section also include the how medical sector invested the computer-aided learning for the education of diabetic people such as the intelligent tutoring systems (ITS), electronic management systems, web-based diabetes advisory system, and Tele-care applications. It also talks about the diabetes chip card and how useful it is in containing the data of the patients. Section 4 is looking at the current and future of diabetes development in UAE. Section 5 concludes this chapter with a quick look at all the technologies that been covered on this chapter with a view of point.

2.1. INTRODUCTION

Diabetes is a common costly condition disease that associated with significant morbidity and mortality (U.S. Department of Health and Human Services, 2002 & American Diabetes Association, 1998). Recent studies have found remarkable increases in diabetes during the last decade (Mokdad, et al., 2000). Diabetes self-management education (DSME), the method of teaching individuals to manage their diabetes, has been considered a vital element of the clinical management of individuals that suffers of diabetes since the 1930s and the effort of the Joslin Diabetes Center (Task Force to Revise the National Standards, 1995 & Bartlett, 1986).

As a key fact more than 220 million people worldwide have diabetes and in 2005, an estimated 1.1 million people died because of the diabetes and about 80% of diabetes deaths occur in third world countries. About 50% of diabetes losses happen in people under 70 years old and 55% of diabetes deaths are in females. World Health Organization predict that diabetes deaths will double between 2005 and 2030, but with a good diet, usual physical activity, maintaining a acceptable body weight and avoiding tobacco use can avoid or delay the onset of diabetes (WHO: Healthmatters, 2010).

2.1.1. What is Diabetes?

It is a disease that influence the way the body uses food for energy and growth. The majority of the digested food is broken down into glucose which is the body fuel. After digestion, glucose goes through the bloodstream and get into cells by the help of the insulin that formed by the pancreas. The pancreas automatically produces the right amount of insulin when people eat to help in moving the glucose from bloodstream into the cells. However, diabetic people have pancreas that either creates little or no insulin, or the cells do not react correctly to the insulin that is produced. Glucose builds up in the blood, run over into the urine, and go out of the body through the urine. As a result, the body gets rid of its major source of fuel even though the blood includes large amounts of glucose (Diabetes Home, 2008).

2.1.2.Types of Diabetes

The National Diabetes Information Clearinghouse (NDIC) states that diabetes has three main types:

Type I diabetes (previously insulin dependent diabetes) is an autoimmune disease. It is an autoimmune disease outcome when the body's system for fighting infection turns against another organ of the body. The immune system in diabetes cases harasses and wipes out the insulin-producing beta cells in the pancreas which then creates slight or no insulin at all. Whoever has type I diabetes has to receive insulin daily to live.

On the other hand, **Type II diabetes** (previously non-insulin dependent diabetes) is the common type of diabetes, where 90% to 95% of diabetes have type II. This type of diabetes is mostly joined with family history of diabetes, physical inactivity, obesity, previous history of gestational diabetes, and certain ethnicities. When type II diabetes is identified, the pancreas is generally producing enough insulin, but for unfamiliar reasons the body cannot use the insulin successfully, a state called insulin resistance. Once several years pass by, insulin production declines. The effect is similar to type I diabetes—glucose builds up in the blood and the body not capable to create efficient use of its major source of fuel. The symptoms of type II diabetes extend slowly. Their start is not as sudden as in type 1 diabetes.

Gestational Diabetes, some women get gestational diabetes in there last months of pregnancy. Even though this type of diabetes generally fades away after the birth, women who have had it have about 40%-60% probability of developing type II diabetes within the following 5-10 years. Gestational diabetes is rooted by a shortage of insulin or the hormones of pregnancy.

2.1.3. Diabetes on Youth

Although no one is sure exactly what causes the body to have type I diabetes, research and science have come up closer to that point. Some parts of the disease are known, while others are still being under study. Investigations in this area have shown that the body of type I diabetic "*turns against itself*" and the T cells of the immune system attack the body instead of protecting it. For unknown reasons, the T cells attack the pancreas's beta cells which create insulin to help change food into fuel. Until 1997, type I diabetes was called "juvenile diabetes" because it almost always found in children. But with researches this disease also influences adults in odd cases; its name was changed to type I diabetes. Scientists are still trying to know the exact cause for the T cells' confusion. Current assumption is that a combination of some sort of environmental trigger and a genetic irregularity. Although that some people can have that genetic abnormality and never develop type I diabetes. The start can be in slow progressing as few years or even quick as few months. Often times, parents report their child had another kind of trauma-the flu, another illness, or even an injury-at the time of begin. Although certain illnesses or injuries can happen just before a diagnosis of type diabetes, they are not the reason of the illness. Rather, the strain of those incidents may have helped stimulate the launch of diabetes. While it is always helpful to catch a disease in the beginning, it is not yet possible to avoid the start of diabetes (McCarthy, 2007).

2.2. TRADITIONAL METHODS TO EDUCATE PATIENTS WITH DIABETES

Old days doctors can educate the patients by showing them some pictures and explain to them their disease. There could be hard copies in the form of brochures, booklets, or soft copies in the form web pages, electronic documents, recordings, videos, etc. Some hospital produces these kinds of hardcopies to give them out for patients to educate them without including any components of an intelligent

tutoring system. Other hospital can provide in-house training for patients and staff as well.

Health facilities provide formal diabetes education but many patients resist this type of education. The mainly common reasons for those not interested were the distance where they lives too far away from the hospital (Greenhalgh, 2001), or they cannot come alone (Dunn , 1998) and busy with kids and family that leaves them with no free time or job obligations (Norris, 2001).

While others with diabetes, unfortunately, once they have received fundamental disease-specific education, they are then usually left on their self to manage the disease for the all of their lives. In some countries like Australia the doctor services has provided medical counsel and help to those living in far distance regions via pedal radio and radiotelephone (Morris et al., 1995).

2.3.HOW CAN E-LEARNING TECHNIQUES HELP THE PATIENTS WITH DIABETES

E-Learning can reduced generally cost and time, as found by Brandon Hall (Hall, 1997), which will help the patients who cannot afford spending money on courses or who are busy and cannot make an additional time to come for classrooms or appointment to learn more about their conditions. E-Learning can cover the regular delivery of content by asynchronous¹ , self-paced E-Learning. Studies support computer-based education as a successful strategy for transferring knowledge and skill development for patients (Lewis, 1999).

Some E-Learning techniques are (Salvatore, 2009):

- **Webinars** – a great way to deliver online simultaneously learning without the cost of travel. Trade opinions and experiences, distribute up-to-date

¹ Event in which instructor and learners are online simultaneously and interaction occurs in real-time.
Examples: Chat sessions, webinars.

content, and create discussion with well-managed and educational web-based seminars.

- **E-Learning modules** – Well-designed, Web- or computer-based instruction can present vital information to all patients. Audio and visuals including Flash content, embedded Podcasts, video, product and process displays, and measurable, interactive testing make E-Learning much better to static educational materials.
- **Social networks** – Twitter, blogs, Second Life worlds, LinkedIn groups, and similar web-based social applications all offer immediate and effective experiences that keep patients connected to the real world. Virtual medical offices and hospitals are used to provide training, and to simplify the patient experience. Patients can contribute to the content in social exchange environments.

2.3.1. E-Learning Technologies for Helping People and Youth with Diabetes

Through the last decades many researchers and doctors invested in E-Learning area. They contributed in many ways to help indeed the people who are suffering of diabetes and other diseases. There is rising confirmation that emerging information and communication technologies might pick up diabetes care and outcomes. Therefore, in this section the work of others in E-Learning areas will be defined and shade.

2.3.1.1. Wrist-Watch Glucose Meters

Disease like type II diabetes and, especially, Type 1 diabetes need regular self-monitoring of blood. A number of studies were conducted in the past decades to create a non-invasive technique for evaluation of glycemia, i.e. a technique does not need blood collection. Yet, it can be stated that non-invasive glucose monitoring is still in its first stage of development. It should be noted that some authors consider “non-invasive” definition as everything that does not require blood collection.

There are some non-invasive meters that can measure the glucose and be wear as a wrist watch. Some of them are available and others are under process.

The meter that is approved and available in the market now is the **Glucowatch, Cygnus Inc.** The meter has a wrist-watch format that by a disposable pad, which clips into the back of the meter, it can test glucose through the skin. There is also another approved meter but it is withdrawn from the market, **Pendra, Pendragon Medical Ltd.** The meter measures how changes in blood work affect the impedance prototype of the skin and underlying tissue. Meters not approved yet like **Aprise, Glucon Medical Ltd.** is stated to be for real-time and permanent blood sugar monitoring, with beeping alarm. It is based on the use of ultrasounds, generated by enlightening the tissue with laser pulses at several selected wavelengths (photoacoustics). Another an unapproved meter yet is **Glucoband, Calisto Medical Inc.** The meter is a wrist-watch. It is based on the exposure of impedance differences in the human tissues due to the application of an electromagnetic field (Tura et al., 2007).

2.3.1.2. Facial Expression as an Adaptive Communications Mechanism

Several theorists have emphasized on the influence of emotional expression to express messages about the expresser as the center of their theories about emotion. In the mid-nineteenth century, Charles Darwin shed the topic of facial expressions expression into a modern scientific treatment and offered the starting point for considering facial expressions as behaviors that progressed as a mechanism of communication. Even though Darwin himself put little weight on the communicative possibilities of facial expression of emotion as an object of adaptive range, the force of his general work proposes this link and encouraged later scientists to elaborate upon this mechanism. Facial expression recognition has attracted key attentions in the past two decades at the scientific community, as it plays a very important role in human centered interfaces. Many applications such as video-conferencing, virtual reality, user profiling and customer satisfaction studies

for web services, and broadcast need proficient facial expression recognition in order to reach the desired results (Pentland, et. al., 2000; Pantic, 2003). For example, Eibl-Eibesfeld has studied facial expressions, such as smiling, and other facial behaviors, for instance the eyebrow flash, in the context of their adaptive importance in a communicative agenda. Continuous technological advances have significantly accelerated the processing speed of embedded systems (Hallinan, 2006), thus facilitating image processing and facial expression recognition technologies (Kanade, 2000). Previously impossible complicated computer-based calculations are common, allowing computers to analyze the facial expressions in real time to perform face-tracing operations (Yang et. al., 2002). The best known facial expression model was by Ekman and Friesen (1975). There are a neutral facial expression and six basic facial expressions related to happiness, sadness, anger, surprise, fear and disgust as Ekman has argued. By implementing those expression into system that reads the children faces or special needs children will help the physicians to communicate better with the young diabetes who cannot express their feeling.

2.3.1.3. Global Positioning System Technology

The Global Positioning System (GPS) is *“a space-based global navigation satellite system (GNSS) that provides consistent location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites”* (Wikipedia, 2010). GPS technology now found in everything from cars to watches and it has become gradually trendier through the past few years for tracking location, but the latest technology of positioning systems is the Indoor Positioning System IPS. GPS has its limits where the roofs, walls and floors block satellite signals and keep them from locating GPS receivers indoors. Even if this has flashed invasion-of-privacy doubts in some, the technology itself is intended to bring useful locator services that are better than GPS. The reason behind IPS can reach where GPS cannot reach is that the IPS technology uses ultrasound, radio or infrared signals to more exactly

track locations where GPS signals are blocked. This technology will help parents to locate their children if they receive a message from their devices that their glucose level is in dangerous level to help them.

2.3.2. Game-based Learning to Helping Children with Diabetes

What is a game? Everybody with all age have played games since earlier to written history (Juul, 2005), suggesting that playing games meets continuing psychological needs (Ryan et al., 2006). A game is a mental or physical competition with an objective or goal, played according to a structure, or rules, that decides what a player can and cannot do within a game world (Huizinga, 1970). Game-Based Learning uses competitive exercises, either putting the players to play against each other or challenging themselves to motivate them to improve their learning. Games usually have a fantasy element that keeps players in a learning task through a storyline. Types of games that can be modified for learning include:

- Video Games or Game-based Learning
- Board and Card Games

Game-based Learning: This category will be discussed in details as it is the category that is related to this study. A video game is any type of game played on a digital device and includes a wide selection of games played in the Internet on PC, or on committed game relieves (e.g., Sony PlayStation, Nintendo GameCube, or Microsoft Xbox) or handheld units (e.g., Nintendo Game Boy, Sony PSP). Positive uses of video games have been reported. This means has been used to study learning (Blumberg, 2000; Blumberg & Sokol, 2004) and selective attention (Blumberg, 1998) in children, to inspect memory processes in college students (Shewokis, 1997, 2003), to improve neuropsychological parameters in the elderly (Dustman et al., 1992), to improve attention span in children with attention deficit/hyperactivity disorder (Pope & Bogart, 1996), to overcome difficulties in teaching information systems (Connolly et al., 2006a), to teach database design concepts (Connolly et al., 2006b), and to ease children undergoing chemotherapy

(Kolko & Rickard-Figuero, 1985). Game-play can teach you valuable leadership and strategy skills as Elliot Noss, chief executive of domain-name provider Tucows, trained to improve his leadership skills by playing a particular video games for six to seven hours a week for the past five years (Lien, 2010). Another example is gamer Stephen Gillett who quickly raised to become the chief information officer of Starbucks in his 20s. Gillett was an eager video player who became a guild leader in the game (Lien, 2010). Engagement is another benefit of computer games where people can spend hours playing a game. Furthermore, people learn the difficult problem solving skills needed to solve the game. (Keller, 1992).

However, the main focal point has been science advancement or therapeutic purposes. Whereas some video games have been developed for health support and educational uses (Lieberman, 1997; Lieberman, 2001), as helping children with diabetes how to manage their disease (Brown et al., 1997), most use clear methods. That is, the subjects are aware of the purpose and goal of the game. To our knowledge, little research is on hand whereby educational information is contained and incorporated in game play strategies (Goodman, et. al., 2006).

Examples of health educational video games are:

- **Egg breeder, Detective, Buildup Blocks** – diabetic awareness game (Aoki et al., 2004): The story of the game is Egg breede, where child learns to breed a diabetic egg by selecting appropriate amounts of glucose, insulin and exercise based on plasma glucose level. The target behavior is diabetes control.
- **Packy & Marlon**– diabetic awareness game (Brown et al., 1997): The story of the game is child as character who has diabetes and the target behavior is to develop self management of diabetic children and adolescents.
- **Insulot** — a cell phone diabetic awareness game (Aoki et al., 2004): This game teach relationships between plasma glucose level, insulin dosage, and food.

- **The Fantastic Food Challenge** – nutrition educational game (Silk et al, 2008): The aim of this game is a quantitative comparative evaluation of three modalities for the delivery of nutrition education (computer game, website pamphlet) - comprising identical content- as to likeability and knowledge acquisition.
- **Squire's Quest!** - a nutrition education game (Cullen et al., 2005): this game is a quantitative evaluation of the impact of the game on dietary behavior.
- **Food Pyramid Knowledge** – a nutrition education game (Munguba et al., 2008): quantitative and qualitative comparative evaluation of the impact of two games (video game board game) both concerning the food pyramid on learning metcognition and intrinsic motivation.
- **First-Aid Knowledge** - First-aid Education game (Tuzun, 2007): It is a qualitative investigation of the core issues and challenges regarding the introduction of video games in schools.
- **Heads Up Hockey**- concussion symptoms awareness game (Ciavarro et al., 2005): Injury awareness during sporting activities game is a quantitative evaluation of the impact of two versions of the game on knowledge about concussion symptoms.
- **Symptom Shock**- concussion symptoms awareness game (Goodman et al., 2006): Injury awareness during sporting activities game is quantitative evaluation of the impact of two versions of the game on knowledge about concussion symptoms.

2.3.3. Mobile Telephone to Educate Users about Diabetes Self-Management

The forecast is that application expansion for mobile devices will explode (Computer Business Review, 2001), with high growth in educational, recreational and social applications (McManus, 2002). The mobile market offers significant

possibilities for educational applications (Savill-Smith & Kent, 2003) with a developing trend in mobile learning for supporting health and relaxation activities.

Short message service (SMS) may be a practical tool for self-monitoring healthful behaviors in children and there were some sms trials done, such as **PumpNet trial** (Benhamou et al., 2007) where the aim of this trial is conventional follow-up of type I diabetics treated with *continuous subcutaneous insulin infusion* (CSII) was compared with intensive lessons using the Internet and the mobile phone network for showing data broadcast and short message service (SMS). This can be sorted as an E-Learning method since it's concluded that long-term telemedical follow-up of insulin pump-treated patients using a mobile phone, SMS and Web-based applications is possible, secure, does not change quality of life and linked with a development toward improved metabolic control.

Another sort of mobile technology that helps patients is the **MPro Care**, the first two-way mobile diabetes solution that provides programmed reminders and allows readings using regular mobile phones on U.S. Diabetes patients text back their blood-sugar readings, which are stored and designed on a patient record card chart in a secure portal for online access by either physician or patient (Butcher, 2009).

There were also another study to study acceptability and efficacy of mobile phone short message service (SMS; text messaging) for monitoring sweet beverages, physical activity, and screen time in children (Jennifer et al., 2008).

In South Korea, the “**Diabetes phone**” was developed by both Healthpia and LG Electronics (Healthpia, 2007). The “Diabetes phone” can also directly calculate the glucose level, send it to the doctors and save it. It also can provide services such as training control, meal therapy, medication control, diabetes education, etc., according to that information. It also gives the amount needed of daily exercise to be considered. To obtain glucose level, litmus paper is used to collect blood from the fingertip and then the diabetic keys a recognition system that is built into the cellular phone. In this way, the patients can measure their blood sugar and find out

how much is the level of glucose is in their blood (Istepanian et al., 2004; Nealon, 2005; Log, 2009).

Japan developed the “**Home diabetes patients supporting system**”, which aims to advance the control of blood sugar levels and stop any problems by using self-measured glucose information gained using the mobile internet. In order to use the self-tested glucose information gathered every day at home, while traveling, etc., by the diabetes patients themselves, it stores the data in the database server at Tougane hospital using any information devices as the mobile, internet, a PC, or a Fax. In the case of the mobile internet, it sends the glucose tester and conducts an automatic transfer of the self measured glucose information. After sending the self measured blood sugar levels, it analyzes the measured data in the Home diabetes patients supporting system, and the analyzed results and doctor recommendations are sent to the patient’s reception device (Group of KangNam Hospital Diabetes, 2005).

The Emminens Service basic functionality contains a Web-based electronic medical record and a messaging system. Patients use SMS to transmit blood glucose levels to a server. Physicians can review online glucose levels and send SMS anytime (Sarria-Santamera, et. al. 2006).

There were several successful systems, that are similar to the mobile phone to manage the diabetes technology, have been used in some parts of the US and Europe. For example in UK there is a system that it’s basic principle was that the user used their sensor watches as usual and kept to their usual routine. The readings from the watches were blue-toothed to their phones, which then broadcasted them to the network at the Oxford centre. The data was analyzed daily and patients get a daily text report to show how well their blood sugar was. Another trial was to send messages to parents who have children with diabetes to inform them of their child sugar level 3 times a day.

2.3.4. Computer-Aided Learning for the Education

The expansion of Intelligent Tutoring Systems (ITS) has been a focal point of applied Artificial Intelligence (AI) in education since the early 1970's (Wenger, 1987). ITSs attempt to carry out the same responsibilities as a human trainer in face-to-face education, for instance explaining main knowledge and how it can be applied to explain individual problems, providing examples, giving hints and corrections, analyzing student solutions and explaining errors (Cheunga, Hui, Zhang et al, 2003).

The first computerized patient education materials were dull lessons that asked patients to memories information and then take exams. These programs change the idea of education to better standard and did little extra than replicate normal written information on a computer screen. There are now a huge number of new computer programs available on health-related topics. Generally labeled computer-assisted instruction (CAI), these programs are usually protective in nature, designed at the well rather than the sick (Reynolds, 1988; Meier et al., 1989). For instance, many programs have been developed for avoiding alcohol abuse (Thomas, 1987; Meier, 1984), teaching adolescents about the penalty of sexual activity (Alemi et al., 1989), educating patients' families and promoting self-care in disease control (Horan et al., 1989; Marerro, 1993).

CAI programs typically have several components, including collection and assessment of individual data, quizzes and other learning activities. Several contain an interactive component with realistic problem-solving or role-playing exercises (Multi-Health systems, 1986). For example, one program called Diabetes in Self-Control (DISC) has helped adolescence reach better scores than their counterparts getting traditional written information in outcomes as knowledge about their disease, management practices such as daily blood glucose levels and glucose monitoring (Mazzuca et al., 1986).

There are some fields that used the computer-aided learning system for education which will be discussed in the following paragraphs.

2.3.4.1. Web-Based Diabetes Advisory System

The use of information technology (IT) solutions seems a promising way to improve the cost/effectiveness ratio of strengthened therapies and to improve the patient/physician communication through telemedicine services. Since the early of eighties, it has been assumed that the use of computer-based systems can be of help in defining therapy and diet in diabetes mellitus. Nowadays, several tools have been implemented and tested in the field. Some of those systems are the following:

Automated Insulin Dosage Advisor (AIDA): is a modeling program which inputs the variables for the management of insulin-dependent diabetes (weight, insulin, and food intake), then curves the results to present the level of blood glucose control throughout a 24-h period (Lehmann, 1998). While **Diabetes Insulin Advisory System (DIAS)** is based on a representation of the human metabolism and is designed as an interactive scientific tool, which can be used by patients with insulin dependent diabetes to predict the effects that might occurred on the blood glucose level if any changes in insulin dose or food. It can also be used to classify risk periods for hypoglycaemia, and to offer advice on insulin dose (Hejlesen et al., 1998). Where AIDA and DIAS are illustrations of model-based systems focused on interactive imitation of insulin and glucose profiles (Salzsieder et al., 2010; Lehmann et al. 2006; Plougmann et al. 2001; Rutscher et al., 1990), **The Karlsburg Diabetes Management System (KADIS®)** is the only system that allows self evaluation of glucose profiles in association with modified metabolic involvement under daily-life situation (Salzsieder et al., 1990; Augstein et al. 2007; Salzsieder et al, 1985). Another system is **DiasNet**, which is an innovative web based system that has been executed. The aim of this system has been expanded; from being used by practitioners to give counsel on insulin dose, to also being used by diabetes as a tool for communication and education. (Plougmann et al., 2001). In addition, **DIABETEX** is a computer-supported consultation, knowledge-based, system for the treatment of type I diabetic out-patients. Three knowledge bases include the medical and technical knowledge for treating either matures adolescents

or children by means of pumps or by injections (Zahlmann et al., 1990). Moreover, **The Chronic Disease Electronic Management System (CDEMS)** was developed by the Washington State Department of Health's Diabetes Prevention and Control Program and it is a free electronic registry. CDEMS is a Microsoft Access Database Application designed as measurement tool for WA State collaborative reporting to assist in monitoring the care of patients with chronic diseases (Washington State Department of Health). Additionally, **Diabetes Electronic Management System (DEMS)** is a second generation diabetes electronic management system. It is used by all members of the diabetes team as well as physicians, nurses, clinical assistants, dieticians, and educators. The system is designed for highest clinical efficiency and facilitates correctly supervised delegation of care. The system is designed to ease the navigation; instant rider of many types of quality audits; automatically produces reports; aids to compliance with fine care guidelines; and alerts, prompts, advisories, and warnings that direct the care provider. The system is in daily use at multiple sites and now contains data on over 34,000 patients (Gorman et al, 2000).

2.3.4.2. Intelligent Tutoring Systems

There are many Intelligent Tutoring Systems that were invented and developed to tutor the people with diabetes as well as the physicians. Some examples of ITS's are:

CAL System: Berridge and colleagues focal point is the need for computer-aided learning to educate the patients and family doctors in the personal care of diabetes, of particular importance given the rising role played by the primary care team in the management of the disease. This interactive system employs multimedia technology to tutor useful skills and promote and combine theoretical understanding. The intend is that such systems should move forward the patient self-care, and in the longer term decrease the rate of diabetic complications and their associated costs (Berridge et al., 2000). Another ITS is **DIABLOG** where it is a dialogue computer simulation program, to education patients with insulin therapy

without supervision. Through mathematical modeling of glucose-insulin dynamics this program is capable to reproduce the profiles of the patients and present them graphically as curve. The subjects could vary their meals, the injection time and dose and could change to insulin pump therapy (Biermann et al, 1990). Whereas, The main idea of **IDEATel** intervention, a technical implementation project of Columbia University's informatics for diabetes education (Starren et al., 2002), is the home telemedicine unit (HTU), that gives four functions: synchronous videoconferencing over usual telephone lines, electronic transmission of blood pressure readings and finger stick glucose, safe web-based messaging and clinical data assessment, and access to web-based educational materials. Offering these functions through HTU needs fixed integration of six components: the HTU itself, a clinical information system, case management software, networking and telecommunications, web-based educational materials, and data security. With more than 400 HTUs installed, IDEATel has established the possibility of large-scale home telemedicine (Adewale, 2004).

2.3.4.3. *Telecare/Telemedicine Application*

There are some difference between telecare and telemedicine. Telecare has been defined by World Health Organization as “... *a remote or enhanced delivery of health and social care services to people in their own home by means of telecommunications and computer-based systems. While, Telemedicine is the practice of medical care using interactive audio visual and data communications. This includes the delivery of medical care, diagnosis, consultation and treatment, as well as health education and the transfer of medical data...*” (WHO). Telemedicine is as a result essentially for doctor-to-doctor, with the patient someplace in the system, and typically engages consultations with specialists at remoteness. There are many telecare and telemedicine application to increase the awareness of people with diabetes and help them to learn more about their conditions. Some examples of the application are:

DIABTel is telecare system that designed to balance the day-to-day care and serious supervision of diabetic patients via telemonitoring and telecare services (Gómez et al., 2002). The system contains two tools, first one is the Patient Unit (PU) used by diabetes in their daily activities and the second one is the Medical Workstation (MW) used by physicians and nurses at hospitals, which is somehow similar to DIABTel principal. Both PU and MW applications; present tools to gather, direct, analysis and read data to exchange data and messages. While, **Multi Access Services for Telematic Management of Diabetes Mellitus (M2DM)** is a telemedicine project aims to offer multi-access services to mobile diabetic patients and residential, to boost the excellence of patient's care quality by improving the ways of communications between patients and care givers (Larizza, et al. 2006; Bellazzi, et al. 2004; Bellazzi, et al. 2003). Another system is **DIABNET** which is a knowledge-based system designed to assist doctors with therapy planning in gestational diabetes. It also aids patients affected by Diabetes in their home monitoring (Hernando, et al. 2000). Moreover, the **T-IDDM Project** which aims to take advantage of the current situation of telecommunications technologies and communications in order to: (i) provide diabetes with useful insulin treatment; (ii) find an suitable level of continuous and intensive care at home; (iii) for the finest use of social and organizational resources and allow for a cost-effective monitoring of a big number of patients; (iv) support continuing education of patient through teleconsultation (Bellazzi, et al. 2001).

2.3.4.4. Social Networking Services

Social networking services are basically online group-forming applications that connect people through common information interests. They let users to find links with people through common friends or connections, build profiles, and update address books (Sharp, 2010). Furthermore, sites like **Meetup** offer social tools to assemble communities of practice with the intention of helping face-to-face meetings all over the world (Meetup, 2010).

Barsky and Purdon claim that social networks are pretty much new sort of virtual communities that define and assemble on member connections by virtue as they are a part of this community. Informal social networking has been presented since the initiation of the Web, but social networking sites have multiplied rapidly since 2003. These communities gather information about users and then store this information as user profiles which are then shared among site members. Social networks shapes as members connects their web pages together, or search through other communities to locate new friends who may have same interests (Barsky & Purdon, 2006).

Social networking services allow users to share information within a network of other users through their profiles linking users to others who have posted similar information. Other links are more ordered, based on user-created groups that normally have expressive titles, e.g. 'UAE Diabetes self-management'. Users can navigate profiles based on criteria or explore the database for users they already know and write to them through public notes on their profiles or private messages. Group messages or announcements can be sent, such as announcements about coming conference or supportive events to those users who identified themselves through particular personality or to answer a specific question that one of the users posts it (Educause, 2006).

Medical and health-related examples of social networking services include the **LibraryThing Medicine Group**, a library social network site encouraging social communications, self-classification, book suggestions, and monitoring of new books. Whereas, the **MySpace** 'CURE DiABETES group' run by patients and supporters. Several social networking services offer multiple features together (e.g. instant messaging, social bookmarking, podcasts and blogs) as **Mental Health Social Network** and the **International Journal of Surgery** (Agha, 2006).

2.3.5. Diabetes Smart/Chip Card

A Smart Card is just as the credit card shape which contains a memory, microprocessor and an interface to the outside world. Roland Moreno developed the original idea of imbedding electronic memory in a plastic card in 1974 and three years later Michael Ugon integrated a processor as well as memory (Denise, 1995). Today's Smart Cards have the compute power and memory of the first PCs. Memory size performance power; consumption and cost are improved dramatically (Lam et al., 1994). For e-health information systems (E-HIS) held by patients, beside the suitable transporter an environment must be provided for the authorized usage of data in the logic of collecting, storing, processing, and communicating the data. First in Europe, smart cards are used for Patient Data Cards (PDC) and Health Professional Cards (HPC) around the world (CEN TC 251, 1999). A portable personal medical record (PPMR) as for example the **DIABCARD** for diabetes patients, would save costs and offer health care personnel and patient with the required and up-to-date medical information at all times. The main requirement of a Chip Card Based Medical Information System (CCMIS) is the treatment of patients with chronic diseases (Engelbrecht et al., 1994). Similar type of those cards is being using at the Imperial College London Diabetic Center in Abu Dhabi, UAE. The card contains the patients file with all the information and the patient must bring the card with him/her every time as one patient's comment.

2.4. UNITED ARAB EMIRATES (UAE) DIABETES STATUS

Turning from international issues to domestic concerns, UAE is considered the second highest diabetes rate around the world. About 19.5% of the UAE's population is diabetic as statistics released that was announced by the Imperial College London Diabetes Centre (ICLDC) at the Arab Health Congress show in 2008. Young children as ten years old are being diagnosed with the disease, due to obesity, coupled with physical inactivity, lifestyle, an unhealthy diet and hypertension. There are not enough health's professionals qualified to deal with diabetes in the region, and there is a huge and vital need not only for "diabetologists" but also nutritionists, diabetic educators and other medical practitioners to help problems arising out of diabetes. There were many studies of the diabetes mellitus in

UAE that have been conducted (Omer et al., 1985; Raupp et al., 2001, 2002; El Mugamer et al., 1995; Punnose et al., 2002; Anvery, 1980; White et al., 1986; Bayoumi et al., 1996; Dawodu et al., 1998; Abdulrazzaq et al., 1999; Miller et al., 2003) and all shows that the diabetes is increasing because of the obesity and lifestyle. However, there isn't any type of E-Learning systems that patient can use to educate themselves. The UAE spent \$436 million (1.6 billion dirham) on diabetes-related treatments in 2007, a enormous cost which could simply be prevented by creating or using E-Learning systems that can raise the awareness and enhance the communication channel between the doctors and patients. There are many centers in UAE that offers knowledge and information about the diabetes to their patients online but there isn't any sort of computer human interaction (HCI). The patients just read what is on the site and the information will be the same every time patients log to the site.

2.5. CONCLUSION

In this review, we presented the definition of diabetes as a disorder of metabolism and its various types. Diabetes patients are from all ages young or old and were treated by insulin. The traditional methods on educating patients with diabetes were by hard copies or by elective courses. However, this sort of education is not collaborating with the increases of diabetes patients in the world.

Therefore, E-Learning can help the patients to learn more about their illness in less time and cost. There is new technology for patients who cannot test their self as the children and the very old people called wrist watch glucose meters that measure the glycemia without the need of blood collection. In addition, the video games show a big positive attitude among the young patients to learn about their problem. Moreover, mobile devices have participated in increasing the level of educated patients and control of glucose levels and prevent complications by providing information SMS to the patients. Another big effort in helping the patients of diabetes is the computer aided learning for education and the variety of having systems that surf both patients and physicians. Beside, the intelligent tutoring systems that interact with the patients and the telecare or telemedicine applications that acts as online clinics to help patients as well.

Chip card or smart card has been used by hospitals and centers to help on giving a profile of the patient's condition stored in their card as what have been used in UAE patients at the Imperial College London Diabetic Center in Abu Dhabi. Although there are many studies shows how series is the diabetes dieses in UAE, there were no much of E-Learning system to help on increasing the awareness of the patients. This might be due to the limited knowledge of the patients on using the right technology.

All in all, a description of technologies and devices to improve and increase the awareness and the education of the people with diabetes dieses are available. Some of the technologies have not been exploited in a device yet, while some others have led to a device at least in advanced prototype condition. It must be noted, however, that currently there are wide arrange of systems that can be employed in hospitals and diabetes centers to enhance the use of technology and E-Learning facility. Although that the technology is on everyone's hand now.

User Requirements for an E-Learning Initial Prototype Design

The chapter presents an overview of the boundaries of the study and the way will be optioned to collect the data and information. Section 1 is an over view of the chapter. Section 2 describes the scope of the study. Section 3 is the method of data collection that has been used in this study including the question that each method covers. In this section also a description of the prototype assessment tools that have been used. Section 4 is the findings and the requirements that have been captured through the data method of collection. Section 5 concludes this chapter with an insight of the purpose of data collecting.

3.1. INTRODUCTION

Throughout this chapter, I will describe the scope of the research then the method of data collection that has been applied to capture the user and systems requirements with the findings. It also will show the interview for each category to capture the requirements.

3.2. SCOPE

This study is to help people with diabetes because there are a growing number of diabetic people in the UAE. As indicated in our study, educating people with diabetes should start at the early age. So, the scope of this thesis is limited to the preschooler aged from 3 – 5 years in Abu Dhabi governmental Kindergarten. It also will consider the opinion of parents/guardian and teacher of those kids by using proper data collection tools that will be discussed in the next section.

3.3. METHOD OF DATA COLLECTION

Program quality assessment tools assess the quality of varied elements of the computer based learning. These tools can include observations of the prototype program, interviews with academic staff or users, surveys, or parents/guardian evaluation. By using these tools, the researcher can examine which aspects of the prototype program are lacking in quality and require improvement. Therefore, methods of data collection are used and mostly include primary data and secondary data. Primary data are new data that have been collected by the researcher whereas the secondary data are data were collected before by another source as research study findings, survey, or interviews. In this thesis the secondary data were collected before the primary data. We used such data in the literature review in Chapter 2. Later the primary data were gathered by the research that suits the purpose of the study. It can be gathered by two method communication and observation method. Some of the primary data that have been gathered are discussed in the following subsections:

3.3.1. Observations

Observation is the most important and general technique of making new discoveries and conducting researches in the field of science. Even an infant in the very early stages of his life observes and is curious about the persons and things surrounding him. He tries to distinguish between various things and persons and recognizes them as being various and different from each other. The observation enhances the knowledge of the child and this increased knowledge, in turn, helps him in making fruitful adjustment with his environs. The observant behavior is not confined to childhood. In the field of scientific knowledge and discovery the man makes new discoveries and learns new facts through observation, first of all. Gradually the cumulative observation leads to invention and manufacture of scientific apparatuses and aids, which, in turn, magnifies remarkably man's power of observation. But in

social sciences observation retains its original connotation of being seeing things with naked eye.

Observation method is a way to collect data from the event using observation tools by the observer. In the words of P.V. Young, “...*Observation may be defined as systematic viewing, coupled with consideration of seen phenomenon...*” (Young, 1962).

In this study the observation was done through observing the potential users and how they deal with the system and their reaction towards it (See Appendix 1). It was structured where the researcher specifies in details what is to be observed and how the measurements are to be recorded. Moreover, it is appropriate when the problem is clearly defined and the information needed is specified. It also was disguised observation, where the preschoolers were unaware they were being observed and thus behave naturally. Disguise is achieved by letting the teacher introduce the program to the users and the researcher stood still away from both and listen only. Because observing the users behavior was in the classroom this observation is natural. The method of administration of this observation was human where the behavior of preschooler was recorded by the researcher himself.

3.3.2. Interviews

This method of collecting data involves presentation or oral-verbal and reply conversation in terms of oral-verbal responses. There are different types of interviews, as follows:

- Personal interviews- where the interviewer asks questions generally in a face-to-face contact to other person.
- Telephonic interviews- when it is not possible to contact the respondent directly, and the interview is availed through telephone conversion.

I used the telephone interviews because it was difficult to set a personal meeting time with experts as they are very busy individuals. So, I asked for this type of interview at their convenient time.

3.3.2.1. Kindergarten Teacher Interview:

I interviewed Kindergarten teachers from Abu Dhabi to know if there is any health awareness they teach to children and how they introduce such awareness in simple attractive way. My interview questions also seeking after the activities to maintain such knowledge and if there any technology involved in this procedures (See Appendix 2). The following paragraphs are the summary of the interview.

I gave a brief summary of my work and what I am working on and asked about the health awareness content on their teaching materials at the KG. Positively they work together to design awareness materials that will allow students to apply health promotion, disease prevention concepts, and principles to personal, family, and community health issues. The core concept is in three dimensions:

- Nutrition and Physical Activity: how consuming a variety of healthy foods and beverages helps a person stay healthy, how being physically active helps a person stay healthy and how drinking water and milk helps a person stay healthy.
- Safety: what are the daily hazards and safe behaviors, the choices that prevent injuries, Identify dangerous objects and weapons, and the safe playing roles they should follow.
- Personal Health and Wellness: personal hygiene practices, the importance of taking care of teeth and having one's own toothbrush to prevent disease, the importance of dental health cleanings, the importance of proper hand washing to prevent disease.

The main focus at this moment regarding introducing the healthy nutrition is the strategies that support such decisions. In the KG the children not allowed to bring chips snacks or chocolate to school. Instead they can bring fruits, vegetables and

healthy foods. The teachers focus on engage the children in activities that are related to both physical development (running, jumping, climbing) and mental development (puzzles, blocks, balancing games). Where, they learn about some aspects of growth and development. Moreover, they focus on teaching them the importance of taking care of their bodies as teeth, eyes, physical exercise, rest, and cleanliness. In addition, they emphasize on teaching the children about the food groups and the importance of food choices and good eating habits and the values of different foods. They include also safety training for the children to explain the importance of being careful around machinery, in the streets, and on the playground. It also covers simple instruction on fire prevention, the use of the emergency numbers, and awareness of poisons. In general, they encourage them to learn and practice health habits and skills for a lifetime.

Teacher's tries to achieve all that by making the kids to understand what is healthy and unhealthy food is in very simple language. They connect words with pictures to make the children understand faster where in this stage children are linking what they see hear and touch. Therefore they ask each child to cut and paste from the magazine what can be as healthy food and each one cut what he/she thinks is health then they discuss it together. In addition to group activities as singing together a healthy related and each month they title it as fruit month, vegetable month, exercise month, healthy smile... etc. to encourage the habits on children and strength their knowledge of each category. But till the moment of the interview there are no computers activities to engage fun and learning to children.

3.3.2.2. Diabetes Nutrition Specialist Interview:

I interviewed some diabetes nutrition specialists from the Maternity & Child Health Department in the Ministry of Health in Abu Dhabi for gaining a better understanding of the right nutrition items for this age (See Appendix 3). My interview questions was designed to know the suitable age to start awareness to children and what kind of activities can be use to teach the children such information. Beside to the symptoms that can be taught to the children to aware

them of their body system and how they can take care of their bodies. Also the interview questions were looking for the way that the nutrition is using on recommending and promoting food habit to children. The following paragraphs are the summary of the interview.

I introduce the work I am working on and asked about the best age to start awareness to children where they stated that they start the awareness for children from preschool stage which is Kindergarten stage for the following reasons:

- Introduce the healthy food for them.
- Show them what other food can damage their body like obesity, teeth, diabetes.. etc.
- Prepare them for school stage where they will have their own money to buy their own healthy snacks.
- Encouraged them to bring health food such as fruit and vegetable and we ask the teachers to ban bringing any unhealthy snacks.

The activities that the nutrition is taking to teach the children such information are varied from illustrations to graphs or 3D diagrams even. They also teach the children simple food guide pyramid and tutor the preschooler in simple language what they can eat and in what quantity. Moreover, they used game based learning but manual using the game of the “Snack and the leader” to teach them that by eating healthy food they will climb the leader and eating unhealthy food they will be drag down by the snack. The main goals of their activities is to increase awareness of the importance of fruits, vegetables and other high fiber, low fat foods to the body. In addition to that they increase the children awareness of food safety practices for and let them know how to prepare some of their own meals by themselves. Plus encouraging the daily physical activity and how that will help their body grow. Mostly they encourage the children to eat fruits instead of chocolates and drink fresh juices instead of soda. Besides advice them that their lunch and dinner should contain some sort of salad and vegetable.

However, there was no education to children on how they know about the symptoms of diabetes but as they said that they usually educate the parents by giving them handouts to inform them about the symptoms of diabetes that can be as finding their children as thirst, passes a lot of urine and always feels hungry but is not putting on weight. They also give general advices on how children can play safe and take care of their bodies during playing such as wearing helmet while driving their bicycle and putting on comfortable shoes. In case that they hurt themselves or get cuts they should go to their parents before germs gets in.

3.3.2.3. Curriculum Designer Interview:

I consulted curriculum designer experts to ensure that my proposed game follows and achieves the Abu Dhabi Educational Council (ADEC) Standards of the Ministry of Education (MoE) in UAE. The interview was with the manager of Childhood Development Center in Abu Dhabi (See Appendix 4). The rationale behind the interview questions is to know to how extend is the ADEC is supporting the health education and if it is a part of the preschool curriculum. In addition to know how the activities are designed to the students to achieve such awareness with what sort of technology.

I introduce the work I am working on and asked about how the health education is supported by ADEC and as she claimed that ADEC have developed a comprehensive new school model that addresses a wide range of issues from curriculum standards to healthy teaching and learning environments. Health education plays a fundamental role in our new school model which will be rolled out in phases, beginning in KG to Grades 3 next year. In addition, we have a number of pilot programs under way addressing different facts of a comprehensive health education system such as the Childhood Development Center in Abu Dhabi. ADEC has partnered with HAAD and SEHA in order to provide each school in Abu Dhabi with a nurse in addition to other medical & health requirements to ensure the best health care is provided to all students.

Then to know how far ADEC is going to reach in such support in the curriculum, the second question was wondering if health awareness is part of the preschool curriculum in ADEC. In ADEC there is a Health and physical education module standards for the preschooler student where they learn about their own growth and development, and they also learn what makes a healthy lifestyle, including the importance of physical activity. The four Strands of the Health and physical education curriculum are:

1. Healthy choices
2. Self and relationships
3. Games, sports and movement
4. Active lifestyles.

Next question was about activities types that preschooler uses to achieve this awareness, where I found that each school is responsible to achieve this standard by their own strategy. Some uses diagrams and pictures, others like to use games and puzzles. It's depends on the teachers to write their own methods and we assess them through it. But unfortunately ADEC are not using any sort of technology for this stage although that they are looking for this step.

3.3.3. Software Evaluation

Software evaluation is a broad term that includes both process evaluation and outcomes evaluation. Process evaluations assess whether a program is implemented as intended, and outcome evaluations assess a program's success in reaching its goals and effects on participants (Administration for Children & Families, 2006; Bowie & Bronte-Tinkew, 2007; Allen & Bronte-Tinkew, 2007).

Evaluating software for teaching and learning is not a straight-forward task. It is quite different from evaluating printed materials. A good deal of the contents of a software package will not be immediately observable and will only appear if the user follows a particular way (ICT4LT, 2011). In addition, there are factors such as screen design, user-friendliness and nature of the interaction to take into account.

The purpose of this evaluation is to assess program quality, program improvement, and child outcomes. The researcher conducts an observation on preschooler prototype users to assess program quality to know if the computer software is more effective/ efficient than other methods and if the game display is pleasing and functional. The feedback from such observation will assess on improving the program performance to achieve better outcomes. The evaluation will be directed to the KG teachers since the users will be evaluated by observations and the information criteria cover the following aspects of the program: relevance to users, appropriate language, organization of information, and information quality (See Appendix 5).

Program quality assessment tools have been used to assess the quality of the E-Learning initial prototype. Because of the young age of the users, evaluation was based on observation and analysis by people who are able to make expert judgment (i.e. User parents or guardians, KG teachers, and researcher). Prototype assessment focuses on assessing users learning and experience to determine whether students have acquired the skills, knowledge and competencies associated with their program study. The prototype assessment tools are helping in improving, informing, and monitoring. It also evaluates the performance of the prototype and the teachers, experts, and parent or guardians expectation in order to improve the prototype.

The results from each assessment tool should provide information that can be used to determine whether or not intended outcomes are being achieved and how the prototype can be improved. The assessment tools also have be designed to inform the researcher about relevant issues that can impact the prototype and student learning outcomes (UWM, 2000).

Table (3.1) provides information about the assessment tools that have been used through the study. It also covers the target user for each tools and the target area that the tool is discovering in each assessment.

3.3.4. Internet Search

Explanatory research is used to clarify concepts and problems. This is used in the literature review in Chapter 2 whereby published works on a range of relevant theories and previous work on E-Learning methods.

3.4. FINDINGS

The requirements that have been captured from the interviews indicate the needs for developing an E-Learning system that deals with healthy nutrition that, children should develop and recognize what healthy and unhealthy food for them. Also, they need to know the food categories and identify the different kinds of food that they are eating. Safe playing guides list that can help the children to protect their selves and others as well from danger by developing the right behavior such as fire safety and traffic safety. Moreover, the diabetes symptoms that the children need to be aware of to know what diabetes are and how it work. As a result, task requirements have been identified as producing a storyboard that consists of three main scenarios to deal with: Healthy nutrition, safe playing guide, and symptoms diagnose.

3.5. CONCLUSION

In this Chapter the scope has been measured and sample size will be determined according to the numbers of kindergarten that will be visited and like to participate with us. The methodological aspects of this study were addressed. The methodological approach of this thesis was qualitative and quantitative. The data collection will be obtained by the researcher his self and data will serve the purpose of developing the system to the needs of the potential users. In the next Chapter will explore the system and the reason of choosing such young age.

A Proposed Prototype of Preschooler Awareness System

The chapter presents an overview of the proposed prototype of raising awareness of diabetes on preschool. Section 1 is a general justification why to use the game-based learning, what are the benefits of using it and the possible challenges. Section 2 is the target age that has been chosen for this study and the reasons behind it. Section 3 is to measure the suitability of the target group to use computer based learning. This section also includes the different studies on preschoolers and computers and how they can control the computer components. It also talks about how game-based learning can help the children to socialize and ease the way of teaching to the teachers. In addition how this can help the children in future and even their teachers to understand the diabetes diseases. Section 4 is looking at the theories that have been involved in this study in both learning and designing theories. Section 5 is covering a description of the prototype that has been designed and its stages of development. It also includes the procedures in each stage and the findings. Section 6 concludes this chapter.

4.1. MOTIVATIONS for GAME-BASED LEARNING

In addition to *Section (2.3.2)* on how game-based learning can help children with diabetes, Game-based learning replicates and produces a virtual environment through the medium such as sound, character, animation, and image. It also provides learners with an experiential and participative learning environment. Today's children are part of the 'digital natives' or 'net generation' of the digital age (Oblinger and Oblinger, 2005; Prensky, 2001, 2006). They *'...require multiple*

stream of information, prefer inductive reasoning, want frequent and quick interactions with content and have exceptional visual literacy skills...(Van Eck, 2006)’ features that are well supported by game-based learning approaches.

A number of studies and statistics support the occurrence of game play. A recent Mori survey of teachers in the UK has found that there are 72% of teachers have never used digital games in their free time, while 85% of the children sample played digital games at least twice a month (Sandford et al., 2006). A report started for Pew Internet and American Life (Jones, 2003) sampled US college students and found that 65% was regular or occasional players, whereas 70% had played digital computer games at least once. In the same survey 20% of those samples saw games as a way to make friends and as a social activity, while 60% used games to fill time when they cannot reach their friends.

Marc Prensky talks in his book “Digital Game-Based Learning” about a new generation of people who are brought up on computers and have never been without a computer and generation brought up on Sesame Street and computer games have joined learning with fun. This is what the author says about this:

“...If you can hold the attention of children, you can educate them.” Sesame Street held their attention as it taught them, day after day, year after year. How? It entertained them. It was fun.

To a huge, underappreciated extent in our training and education we offer the Games Generations very little worth paying attention to from their perspective, and then we blame them for not paying attention. Many of the people accustomed to the twitch- speed, multitasking, random-access, graphics-first, active, connected, fun, fantasy, and quick payoff world of their video games, MTV, and Internet feel bored by most of today’s approaches to training and learning, well meaning as it may be and, worse, the many skills that new technologies have actually enhanced (e.g., parallel processing, graphics awareness, and

random access)—which have profound implications for their learning—are almost totally ignored by education and training.

From years of “new media socialization” and profoundly affecting and changing the generations’ learning styles and abilities, that cry out for new approaches to learning for the Games Generation with a better “fit.” And while certainly not the only way, computer games and video games provide one of the few structures we currently have that is capable of meeting many of the Games Generation’s changing learning needs and requirements. This is the key reason why Digital Game-Based Learning is beginning to emerge and thrive... (Marc Prensky, 2001)”

Schools need to use the same way to educate children in the classroom; the use of interactive game-based learning will achieve this.

4.1.1. Benefits of Game-Based Learning

The benefits of game-based learning are extensive, but as studies have revealed the use of game-based learning is most successful with users who take pleasure in learning with games (de Freitas, 2006; de Freitas et al., 2006) and for that reason its most useful use may need to be distinguished accordingly to learners’ specific requirements (e.g. according to skills and competencies, learning level). There are also some other areas that makes game-based learning useful tools such as (JISC, 2007):

- Motivation is a key aspect of successful learning, but that motivation needs to be continued through feedbacks, active involvement and reflection in order to inform the user of his progressing. game-based learning can sustain in motivating the users by giving them feedback on their progressing and their score. Producing a learning environment inside a game would get the most out of a wonderful opportunity.

- Engagement is another benefit of game-based learning. Users can spend hours playing a game and not be aware of the time they have spent. Moreover, the things people learn from a game can be capitalized on. For example, a football game will demonstrate the many pass and run plays a person can choose from and enact. After a short time of playing the game, they will begin learning the name of the plays called and the strategy behind them.
- Integrating a variety of tools together has been a one of the biggest challenges for E-Learning, as often tools that have possible uses for learning are not always as simply integrated into educational systems. Also, technical restrictions (e.g. firewalls, the graphics capability of available PCs, memory size... etc) can often make ready access to new tools hard. However, game-based learning does offer the achievable to integrate different cognitive tools.
- The student can learn at their own speed, which is different than the traditional approach where everyone learns together at the same speed which could leave people behind which can be bad if the person has learning difficulties, the traditional approach makes the assumption that everyone is the same, at the same level so everyone has to get to the teaching level, computer based/aided learning can be tailored for the Individual so you can start teaching where they are.
- The computer systems are sometimes interactive which makes learning fun some people find it easier to learn when the group of doing so fun as was shown earlier, in Section (4.1), of the idea of the new generation brought up on Sesame Street and computer games, sesame street helped children to learn because it was fun.
- Game-based learning generates positive learning attitudes in students.
- Game-based learning takes less time to do then traditional methods.
- Computer based environments are sometimes used to simulate real situations such as operations, earthquakes etc, this is ideal as the student can experience the situations in a safe environment.

- Computer based learning applications can have multimedia built in to it so not only can you read the text but you can see videos and hear sounds, so learning new languages such as German etc become easier as you can hear what the word should sound like.
- Programs can be put on to CD-ROM or DVD or internet so people can get hold of the course materials easily.

4.1.2. Challenges for Using Game-Based Learning

Some of the challenges of using game-based learning and they can be easily overcome are:

- Learner's expectations of game-based learning are based upon home use games (de Freitas, 2006). They are clearly expecting more engaging learning contact as they used to at home. They might think that they can use the game-based learning as long as they want and drop it when they want, which is wrong. The game-based learning is under particular agenda where the time and level are calculated to each user. Therefore, it's essential to advice the learner on the way they should spend their time in such systems.
- The technical issues to implement a whole place of computerize classrooms if it's not available at all.
- If the place does not equipped with computers or computer lab this can be costly to built one.
- Some academics want to use game-based learning and have fantastic ideas, but couldn't produce a game, even with tools. Many games designed by academics tend to be very behaviorist, simplistic stuff, and drag-and-drop – arguable they're not even games.

4.2. PRESCHOOL STAGE OR ELEMENTARY STAGE

I was trying to determine which best age to start the awareness with either preschool stage or primary stage. But after the interview I conducted with the nutrition specialist and little quick research, I found that children develop many food attitudes, behaviors, and preferences during the preschool years (Birch et al., 1991). Nevertheless this is also the time when young children seem to move naturally through a developmental stage of food neophobia or fear of new foods (Birch, 1998).

Moreover, it is vital to begin as early age as possible to reach both parents and children before they have had time to establish incorrect behavior that is more difficult to be change the older the child gets. Kauffer- Christoffe proves that early timing as she said that the "...*window of opportunity for prevention is not long*...". Healthy eating habits are essential for the usual development and growth of preschool children and to stop nutrition related diseases later in life (Dietz, 1994).

In order to prevent health, social problems, and psychological it is necessary to start following risk features for this condition as early as possible in life then in later ages (Ball & Mc-Cargar, 2003; Dietz, 1998a; Reilly et al., 2003; Slyper, 2004). The early years stage is the best opportunities for preventing childhood health problems where the cycle can be possible stopped and be redirected to healthy patterns (Ariza, 2004).

Food habits that build up during early life are maintained as children enter school (Singer, 1995), and the nutritional choices of elementary school-aged children track into teenage years (Kelder et al., 1994). Therefore, nutrition education during the preschool years may provide a base for permanent healthy eating habits. In USA, nutrition education is required in Head Start programs (US Dep. H & HS, 1974) and incorporated into many private preschool programs. Also, The American Dietetic Association recommends food and nutrition education as a regular component in programs for children to ensure health promotion and disease prevention (Am Diet Assoc 1987, 1994a, 1994b & 1996; Plum et al., 1998). However, there is little theory-based research to update nutrition educators of the

most proper content and the most helpful format for preschool nutrition programs (Matheson et al., 2002). Childhood food preferences are not only predictive of nutrient intakes; research studies have also confirmed that early food choices are predictive of adult food preferences (Pliner et. al., 1993; Rozin et.al., 1986). Therefore, positively influencing food preferences during early childhood may assist in the founding of lifelong healthy food habits (Young, et. al. 2004).

For all the above reasons, I chose the preschool children age rang to be my focus point in this research.

4.3.THE SUITABILITY OF PRESCHOOL FOR COMPUTER BASED LEARNING

Since I am going to use the preschool stage in my research I need to justify the suitability of this stage to engage with computer based learning or E-Learning experimenting. The present followers of very young children are exceptional; in that they are the first generation who can bares the technologies, computers, other media, and other cognitive tools at the same time. This early experience is probable to create mind and computer innovations integration that today's adults may be not capable to develop on their own. Through this review I will explore the different studies on preschoolers and computers and how they can control using those technologies which can be the first lead in helping them to socialize with others. Also I will discuss the different software preferences and how this technology can ease the way of education and teaching.

4.3.1. Different Studies on Preschoolers and Computers

The use of computers into preschool classrooms is a recent trend and much still needs to be learned about how children and their selection of activities are affected by this new technology. A small but gradually growing literature has established some vague information about computers and preschoolers, mainly in relation to favorite for the computer by age and sex (Swigger, Campbell, & Swigger, 1983;

Williams, 1984) and to the social impact of the computer (Swigger & Swigger, 1984). Williams (1984) also found no important age difference in between preschoolers under and over 5 years.

4.3.2. Preschoolers Can Control the Computers

Sprigle and Schaefer (1984) found that age linked to preschoolers' capability to program graphics and make line guesses in the drawing of shapes. Also a study finding done by Muller (1985) findings indicates that preschool age children are able to interact effectively with standard keyboard and can use a computer with the software provided is age suitable and the context is effectively structured. Children need to know computers nature and uses in order to be capable to catch up with the present and future technological society challenges (Haugland, 2000b; Lipinski, Nida, Shade, & Watson 1986; Lomangino, Nicholson, & Sulzby, 1999; Nastasi & Clements, 1992; Nicholson, Gelpi, Young, & Sulzby, 1998; Solomon, 1998; Teng, 1997). That's mean they have the ability to understand the basic functions of computers and know how to control the mouse and keyboard device.

4.3.3. Help Socializing

In addition, using the computer in the classrooms can encourage the preschooler to socialize and work with their colleagues as a team work. The research has showed that the computer corner in the classroom is an active ground for social interaction, as children often rather working with a peer to use the computer alone which indicates that social encounters increase while children are engaged in computer activities (Bergin, Ford, & Hess, 1993; Haugland, 1997a, 2000a; Hawkins, Sheingold, Gearhart, & Berger, 1982). According to Haugland (1997a), rumors on attitude patterns of dealing with computers may deliver to organize unique patterns of interacting around computers. Hawkins et al. (1982), who found high levels of cooperative behavior in school-age children exposed to a computer curriculum.

4.3.4. Different Software Preferences

Also, the preschooler will develop skills using the computers software and they might have difference demands on type of software to use either its question answer programs or matching or even story to be told and it will influence the children's type of play (Fein, Campbell, and Schwartz, 1987). Sherman et. al. (1985) explored software preferences of little children where they preference the problem solving than drill-type software. Therefore, computers allow for adaptation, development, and delivery of tools that may ease more effective thinking, learning and problem solving (Haugland & Wright, 1997; Papert, 1993). A Muller (1985) result also indicates those preschoolers are able to participate in a problem-solving situation.

4.3.5. Can Ease the Way of Teaching

Although there were earlier concerns of computers being too theoretical and difficult for young children to use (Clarke, 1990; Hattie & Fitzgerald, 1987), learning to use computers can support children's development where many academics now believe that computers can be used to achieve learning and development in young children education stage if they are correctly used.

The computer not only provides us with new task for children to master, but it is one more tool for children to use in learning and mastering the world of common experience (Hohmann, 1994). It can ease the way of teaching for teachers and help them to develop the message to those kids. Hohmann (1994) confirmed that teachers, who are support lunching computers into their preschool classrooms, usually believe that computer activities can support independence and ease the normal activities of early childhood classrooms. Early childhood educators regularly develop helpful learning techniques and create proper strategies to integrate computers into the classroom. Those strategies are easy for teachers and in peace with the emotional and social needs of children (Haugland, 1997b; NAEYC, 1996; Shade, 1994). Together with a suitable program, children are able to experience pleasure by playing games in education (Haugland & Shde, 1988; Haugland & Wright, 1997; Papert, 1993; Teng, 1997).

4.3.6. Safe & Understandable School Environment

Children in primary school will most likely accept a classmate who has diabetes. They are expected to show more curios in why he/she is allowed to eat in class whereas they are not allowed. They might wonder if this child has developed diabetes because he/she had done something incorrect, they may even doubt if diabetes means that he/she will pass away, and they need to be told that they will not catch this disease by sitting around diabetes children (Ingersoll & Golden, 1995).

The school and teachers need to know how diabetes affects a learner's capability to function effectively in the classroom. For example a nine-year old learner described how he felt when his blood sugar was low: *"I feel weak irritable, hungry and ready to kill anybody that bothers me."* A thirteen-year old said: *"It feels very weird. Sometimes I don't even know I am high. When I do think I am high, I feel like I am going to throw up, and I feel like I need to drink every 5 seconds or go to the bathroom"* (Rosenthal-Malek & Greenspan, 1999).

All in all, the quality of software used in the classroom decides the point to which children will benefit from its use. The point statement on technology issued by the NAEYC (1996) shows that computers in the classroom can be an optimistic power, as long as they are applying the guidelines for developmentally appropriate practice (DAP). Therefore, it's a good asset to have computers in preschool classes to help on shaping and building the abilities and personalities of tomorrow's leaders.

4.4. THEORIES

The usual education theories can be implemented to E-Learning techniques and the new joint of GAME-BASED LEARNING in educational will raise a whole new set of theories that deals with the learner's behavior and learning techniques. There are many theories that can be linked with the proposed prototype that it would be

unfeasible to include them all. Therefore, the theories that are most relevant to this prototype design will be included.

Table (4.2) will cover the learning theories that have been used in designing the prototype as the intrinsic motivation, cognitive apprenticeship, and Experiential Learning theories. While table (4.3) will cover the designing theories that have been implemented in the prototype such as Media Equation, Discovery Learning, and Guerilla HCI theories.

4.5. DESCRIPTION OF PROTOTYPE

Observations and interviews was the main tool used to gain data about the useful information that will determined the flow of the primary storyboard/prototype for children aged between 3-5 years old (KG 1 & 2) weather they are diabetes patients or not. The aim is to spread awareness among those kids weather they have the disease or even to educate them that they will have the required and minimum knowledge. I chose this age rang because it's easier to change or plant habits in very young age and this is the first kids' exposure to outside behavior. A total of 9 children from 3 different kindergartens in Abu Dhabi were tested as the first & second stage. Table (4.4) shows the breakdown of participants according to their gender and age.

KG in Abu Dhabi	Male	Female	Age			Total
			3	4	5	
3	4	5	3	3	3	9

Table (4.4): Distribution of experiment participants in stage 1 & 2

Then in the final stage a total of 50 children from 5 different kindergartens in Abu Dhabi were tested and they are divided into group of females and males students. Table (4.5) shows the breakdown of participants according to their gender and age.

KG in Abu Dhabi	Male	Female	Age			Total
			3	4	5	
5	21	29	10	20	20	50

Table (4.5): Distribution of experiment participants in the final stage

4.5.1. The Storyboard Scenarios:

The storyboard will consist of 3 main scenarios that will deal with healthy nutrition, Safe playing guide, and Symptoms diagnose. Each scenario will have at least 2 games or more even to level up the awareness of the children on this early age.

1. Health Games targets the health awareness.
 - a. Nutrition Awareness: This story of the game is “Drug & Drop”, which game help on developing the awareness of the child to know what are the healthy food and what is the unhealthy food for them. This will develop the healthy food habits.
 - b. Food Pyramid: The story of the game is “Match the food”, where children will know the food categories that will help them to understand how much portion their body needs. This game will develop healthy food habits.
2. Playing & Safety Games targets the safety awareness.
 - a. Playing Safety: The story of the game is “What’s Wrong?”, where child learns the write behavior and identify the wrong behavior by selecting appropriate pictures.
 - b. Fire Safety: The story of the game is “Is it good or bad?”, where child introduced to the fire safety and how know how to avoid fires and what might cause it by selecting appropriate pictures.
 - c. Traffic Safety: The story of the game is “Traffic lights”, where child will be introduced to the traffic lights color meaning to avoid any traffic accidents by matching the write color of traffic with the write sign selecting appropriate pictures.

3. Diabetic Games target the diabetes awareness:
 - a. Diabetic Diagnoses: The story of the game is “Are you Diabetic?”, where child will know the symptoms of diabetic and compare his self with them by determining if he have the symptoms or not.
 - b. Bank of Information: The story of the game is “Give me answer; take a golden a coin”, where child will know that what he eats goes to the stomach and break down into a simple sugar called glucose, which is his body's main source of fuel. The glucose passes into his bloodstream, where a hormone called insulin helps the body's cells use the glucose for growth and energy and if the insulin not available the cell will not get any glucose. They will know also that insulin is produced by the pancreas behind the stomach. In a healthy body, the pancreas automatically produces the amount of insulin needed to move the glucose from the blood into the cells. They will learn that by a game that will give a golden coin for each right answer.

4.5.2. First Stage

I designed a simple sketched storyboard after collecting data from the interviews with the KG teachers, curriculum designer and the nutrition specialist. Then I designed a Power Point presentation slides to give the right effect to the viewer. Program quality assessment tools have been used to assess the quality of the E-Learning initial prototype. Because of the young age of the users, evaluation was based on observation and analysis by people who can make expert judgment (i.e. User parents/guardian, KG teachers, and researcher). These tools include observations of the use of the prototype program, and evaluating the prototype by academic staff and parents/guardian to implement the required improvements. Table (3.1) provides information about the assessment tools that have been used during the evaluation phase of the prototype. It also covers the target user for each tool and the target area that the tool identifies in each assessment.

4.5.2.1. Preschool Users

The preschool users are 9 children divided as the following: 3 kids in the age of 3 years, 3 kids in the age of 4 years, and 3 kids in the age of 5 years. This test is through an observation that test motivation, engagement, user interface and the learning information gained. The observation was by letting the kids trying the system and the researcher observed them through the EDUCATIONAL SOFTWARE OBSERVATION for preschooler tool.

The “EDUCATIONAL SOFTWARE OBSERVATION” tool was designed to measure some aspect of the Socio-emotional Development, Physical Development, Intellectual Development, and Software evaluation performance. The result of the observation indicates that the socio-emotional development aspects reach 83% satisfaction where it is looking at the teacher/instructor introduces the subject to the users, observe the users interest through playing, students share answers, and if students demonstrates confidence in self and can work independently. Then the physical development aspects is 100% satisfaction where it observe if the children developing eye-hand coordination, sensory awareness, and if they are interacting with the system. Intellectual Development aspects reach 95% where it observe if the children is developing a positive attitude towards learning, using language to bring meaning to what is learnt, developing logical thinking skills through a variety of activities as classifying, organizing, matching... etc, are listening for information, directions, and explanations, they can understand the vocabulary, they understand their answers, and if they can know if their answer is right or wrong. Finally is the software evaluation aspect where it gets only 67% which is the lowest percent. The observer was evaluating the system through the users to know if they are interested on the system, if they can go back to re-answer the wrong answers, and if the font is suitable. The user's could not navigate forward and backward in the system which is not motivating them as the “Intrinsic Motivation” theory suggest that to motivate the player by being in control of the game and they can go to the next step or go back to re-correct a previous answer. Students can learn from their mistake as “Cognitive Apprenticeship” theory support that the game that provide an immediate feedback to a player's action is an effective learning tool that give the players a

chance to correct his/her mistake. Overall in the observation the children show a positive development in all the aspects. As shown in Figure (4.6).

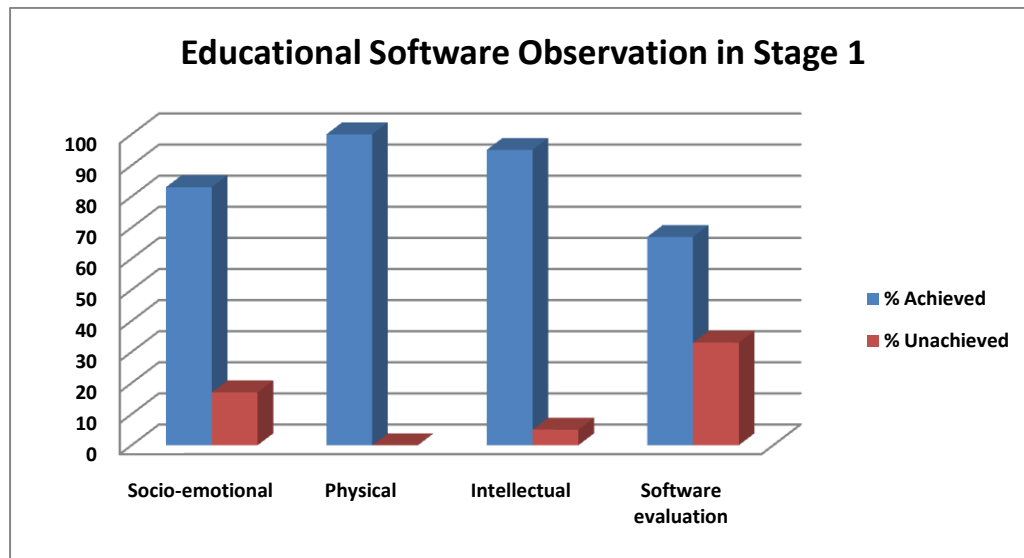


Figure (4.6): The satisfaction of the software performance in stage 1.

4.5.2.2. Content Expert

Furthermore, user testing involved content experts to ensure the validity of the data provided. The content experts in this stage are the nutrition specialist, who insured that the nutrition information's are correct and suitable for this age, and the KG teachers who were involved to know if the content is suitable for the preschooler use.

The teachers of the users and their parents/guardian were also questionnaire to give feedback on the initial system in order for future development and improvement. A group of 15 participants were participating in evaluation the 1st stage prototype by using the "Educational software evaluation" tool. The questionnaire was evaluating some aspects of; the educational value and pedagogy, in addition to the effective use of computer as an E-Learning tool. The evaluation shows that the educational value and pedagogy aspects of the prototype exceed in its first stage 75% excellent,

13% good, 6% satisfactory and 6% poor performance. While the effective use of the computer aspects were 100% strongly agreed, where it evaluated the computer effective/efficient than other methods, game display is pleasing and functional and audio is effective if it's available as table (4.7) shows.

	Excellent	Good	Satisfactory	Fair	Poor
Educational Value and Pedagogy	75%	13%	6%	0%	6%
	Strongly Agree	Agree	Disagree	Strongly Disagree	Neutral
Effective Use of Computer as an E-Learning tool.	100%	0%	0%	0%	0%

Table (4.7): Evaluation Result of the KG Teachers, Parent/Guardian, and Nutrition Specialist

4.5.2.3. First Stage Findings

The main suggestions for improvements and research findings highlighted the needs of navigation mechanism in order that the children can learn from their mistakes with audio sound. Some other areas that can be consider are the flowing:

- The program must have a scaling to motivate the learners.
- Colorful animation is desirable
- A feedback way that give the users the chance to go back and know their mistakes or in the result after each move.
- A way that allows the children to re-answer their incorrect answers.
- Some pictures must be change for clearer ones.

As a result of the user testing, a second story board will be created after the alteration and the same users will tests again the second storyboard/prototype using the same method described earlier. The results from the second storyboard/prototype will determined the final design platform of the storyboard and thus design becomes an iterative process that will use bigger sample at the end.

At this point of the research, a presentation in Health Informatics Research Workshop at Liverpool Hope University, UK, was presented on the 24th of March 2011 (See Appendix 6). In addition to a paper was published in IEEE (See Appendix 7) and presented in the Seventh International Conference on Innovations in Information Technology (April 25-27, 2011, Abu Dhabi and Al Ain, UAE) in e-Health session at the Innovative Services for a Smarter Planet (See Appendix 8).

4.5.3. Second Stage

Considering the result from user testing on the first stage many alterations has been done on the prototype using web page design (See Appendix 9). Sound have been added and navigation mechanism to facilitate and to ease the moving forward and backward to the children that they will get feedback on their work and learn from their mistakes. However, in the second stage same users who tested the prototype will test the second version of the system and will give feedback that final touches will be done that will give us the chance to produce a professional final system. The second stage test users are the following:

4.5.3.1. Preschool Users

As used in the first stage, the sample in the second stage will be the same group that tested the prototype in the first stage 9 children and divided as previously, 3 kids in the age of 3 years, 3 kids in the age of 4 years, and 3 kids in the age of 5 years. The observation used also the educational software observation for preschooler which was used in first stage. The result as the following:

The result of the observation indicates that the aspect of socio-emotional development increased to 92% satisfaction, the physical development aspect become 100% satisfaction, Intellectual Development aspect remains 95% and the software evaluation jumped to 100% which was in the first stage only 67%.

Overall in the observation the children show a positive development in all the aspects. As shown in Figure (4.8).

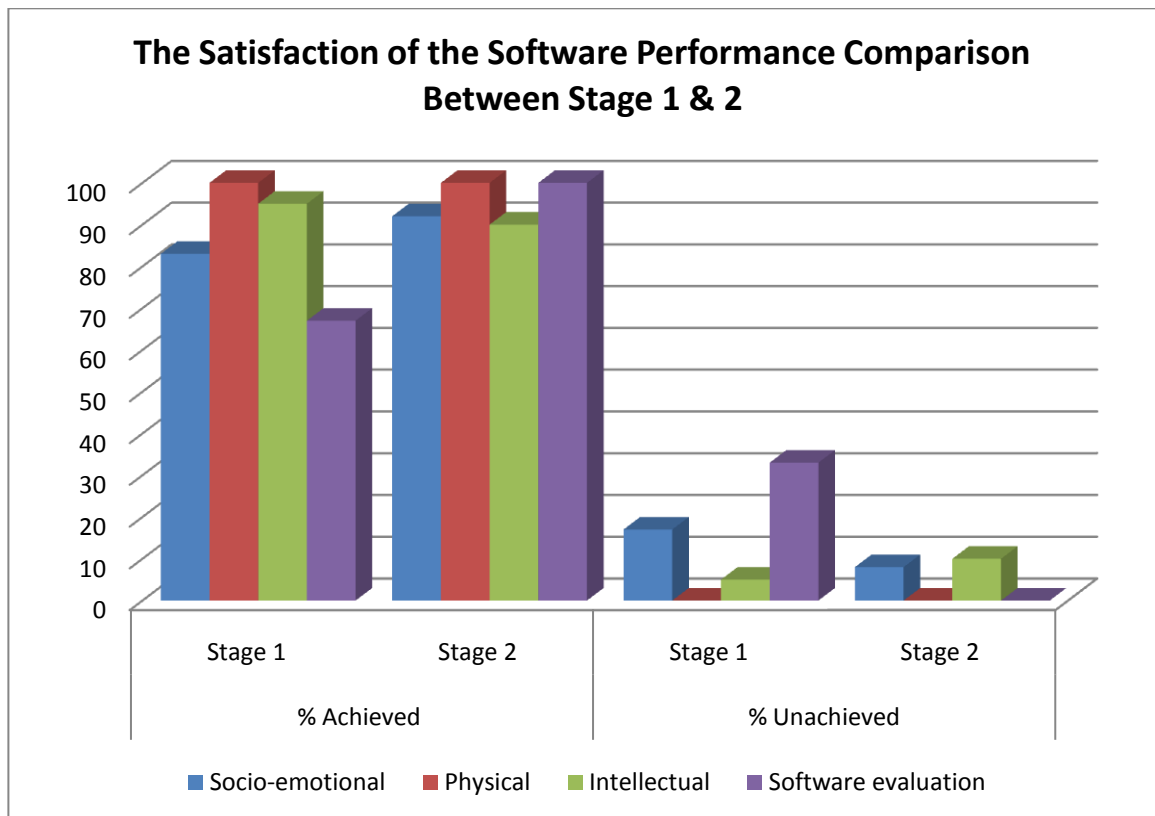


Figure (4.8): The satisfaction of the software performance comparison between stage 1 & 2.

4.5.3.2. Content Expert

Additionally, user testing involved KG teachers only in this stage to give feedback on the second prototype alteration and they were satisfied with the upgrades on the system. They find that adding audio to the program will give the children hint about their progressing in addition to the messages that give them feedback on their answers. Also the navigation processed as they said is much better which can help the children to learn from their mistakes. These upgrades will hold the children attention and will motivate them to learn.

The teachers of the users and their parents/guardian were also questionnaire to give feedback on the upgraded system in order to finalize the system development. Same group were tested in this stage using the same tool. The evaluation shows that the educational value and pedagogy aspects of the second prototype improved to 83% excellent, 10% good, 5% satisfactory and 0% poor performance. While the effective use of the computer as an E-Learning tool were still 100% strongly agreed as table (4.9) shows.

	Excellent		Good		Satisfactory		Fair		Poor	
Stage	1	2	1	2	1	2	1	2	1	2
Educational Value and Pedagogy	75%	83%	13%	10%	6%	5%	0%	2%	6%	0%
	Strongly Agree		Agree		Disagree		Strongly Disagree		Neutral	
Stage	1	2	1	2	1	2	1	2	1	2
Effective Use of Computer as an E-Learning tool.	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%

Table (4.9): Evaluation Result of stage 1 & 2 of KG Teachers, Parent/Guardian, and Nutrition Specialist.

4.5.3.3. Second Stage Findings

The finding shows the improvement of the prototype from the first stage, but there are some areas that yet needed to be improved. The main suggestions for improvements and research findings highlighted the changes that we made according to stage 1 findings. The first stage suggested to implement a mechanism to allow the children to re-answer their incorrect answers. Which conflict with the findings of this stage where we are looking to develop a system that keeps a record of each child experience to track their improvements and learning outcomes that has been made. In addition, the record will allow to keep an open eye on the children who might have the symptoms of the disease. Therefore, each mistake should not been corrected to know how many times the child find difficulties to answer it.

Another thing is the needs of finding a platform that can be easy to use and navigate with smaller size. Also to develop a system to keep a record of each child experience to track the improvement and learning that has been made and to keep an open eye on the children who might have the symptoms of the disease.

4.5.4. Final Stage

This stage was based on the outcome of stage 1 and 2 findings where we tried to find the suitable platform for this prototype final shape. After long search on deciding which program to use finally "Adobe Captivate 5" was the chosen software to be used in order to produce the final platform of the proposed prototype which will be an effective mode of E-Learning. The software integrates audio and offers a customized interface for the learner to navigate and explore the simulation. In addition, the assessments and quizzes can be easily created in professional looking way using features such as bespoke buttons and enhanced backgrounds. Captivates' new Question Slide presets set up multiple choice, fill-in-the-blank, true/false quizzes and so on. Most powerful of all is the ability to design the test by adding click-boxes that must be clicked on correctly before users can progress into the slides and the author can set up the automatic emailing of scores. In this prototype the answers will be stored on internal server on the laptop as we decided to use the laptop to test the prototype instead of renting a domain or URL in the internet for such short period and also because its only prototype that is not for commercial use.

This final prototype version or platform will be ready to be used right away with a system that can track record of each student to give the teacher the chance to know their awareness level and if there is any needs or worries that can be consider that might relate to the child health.

4.5.4.1. Preschool Users

The preschool users are 50 children from 5 different Kindergarten government school in Abu Dhabi divided as the following: 10 kids in the age of 3 years, 20 kids in the age of 4 years, and 20 kids in the age of 5 years. The observation used also the educational software observation for preschooler which was used in stage 1 & 2. The result as the following:

The result of the observation as shown in Figure (4.10) indicates that the aspect of socio-emotional development increased to 98% satisfaction, the physical development aspect still 100% satisfaction, Intellectual Development aspect reached 96% and the software evaluation reduced back to 67% and that's because the student cannot change their wrong answers. They can see the right answer but as long as they submit their answers their answers will be marked and they cannot change it back. This is an important matter to the teachers that they can know who have any difficulties and who got problems in answering questions.

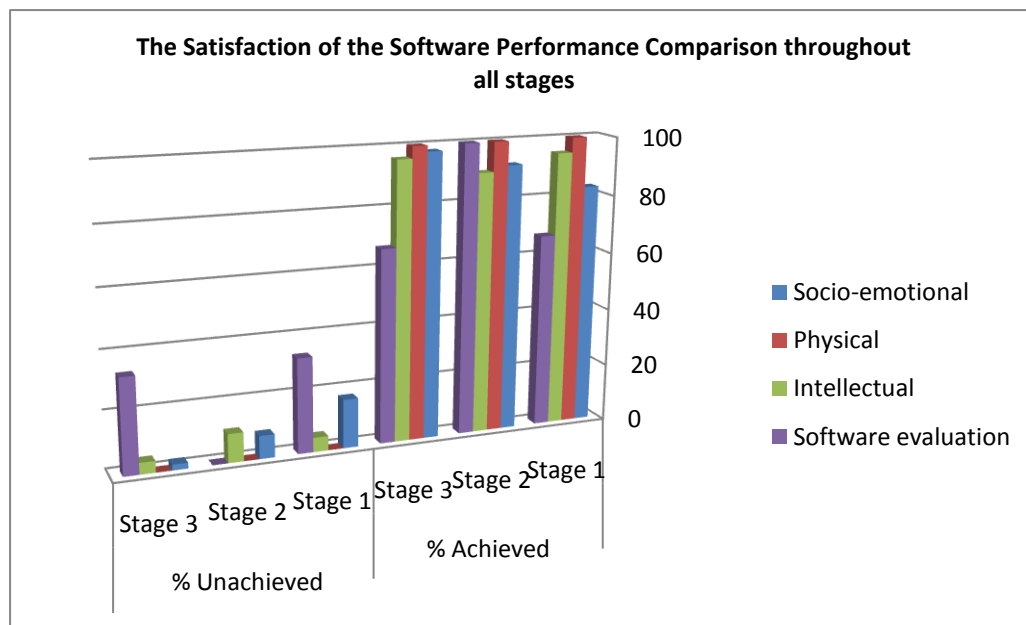


Figure (4.10): The satisfaction of the software performance chart comparison throughout all stages.

Overall in the observation the children show a positive development in all the aspects that indicates the success of the final E-Learning system. As shown in

Figure (4.11) the observation shows a continues progress on the children behavior and the one aspects that was not stable was the software evaluation performance. That's due to the fact that the teachers wanted a way to track the progress of each child so we had to change the ability of going back to re-answer the wrong answers. We needed to have a record of each game and the total attempts of answering them. Also the numbers of children who have difficulties in answering such question may indicates a problem on understanding the game concept. Therefore, some new changes might be needed to ease the game for the children.

Some Aspect s of	Stage 1	Stage 2	Stage 3
Socio-emotional Development	83 %	92 %	98 %
Physical Development	100 %	100 %	100 %
The Intellectual Development	95 %	95 %	96 %
Software Evaluation Performance	67 %	100 %	67 %

Figure (4.11): The satisfaction of the software performance table comparison throughout all stages.

4.5.4.2. Content Expert

Additionally, user testing involved KG teachers only in this stage to give feedback on the final platform of the prototype and they were satisfied with the final system. They found the tracking record of each child is useful and easy to use. Also the navigation processed as they said improved in a way they did not think about it where the kids can process on the game without stopping in a point that can make him/her give up and get board of the game. These upgrades will hold the children attention and will motivate them to learn.

The teachers of the users and their parents/guardian were also questionnaire to give feedback on the final platform system in order to finalize the system development.

A group of 15 participants were participating in evaluation the final prototype by using the same tool. The evaluation shows that the educational value and pedagogy aspects of the final prototype improved to 97% excellent, 3% good performance. While the effective use of the computer as an E-Learning tool were still 100% strongly agreed as table (4.12) shows.

	Excellent			Good			Satisfactory			Fair			Poor		
Stage	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Educational Value and Pedagogy	75%	83%	97%	13%	10%	3%	6%	5%	0%	0%	2%	0%	6%	0%	0%
	Strongly Agree			Agree			Disagree			Strongly Disagree			Neutral		
Stage	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Effective Use of Computer	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table (4.12): Evaluation Result of stage 1, 2 & 3 of KG Teachers, Parent/Guardian, and Nutrition Specialist

4.5.4.3. Final Stage Findings

The finding shows the success of the prototype to deliver the message of awareness to the children in addition to their KG teachers and their parents as well. The flow of this stage was smooth and accurate after all the amendments that have been done through according to stage 1 & 2 findings. The Health and Playing & Safety games were successful and the majority of the children got them right from the first try but the only thing that we should consider is the diabetes awareness games. In the “Are you diabetic?” Game the children did not know what do we mean by “many times” for example when we said do you drink a lot of water they will answer yes although they are drinking on the regular portion that everyone should drink. They also did

not have what we mean by saying going to the bath room many times where they will say yes we go 5 times which is normal. Therefore more explanation should be given to the kids to understand what we mean by those questions. On the second game, most of the children got some difficulties to understand the new terms as Glucose, Stomach, Insulin, and Pancreas... etc. They also need to hear what is going on first or see it as short movie or flash to understand how the food break up and turn into glucose and so on. Then we can expose them to the game to track their understanding.

In addition, the use of Adobe Captivate 5 allows us to use the Captivate Quiz Result Analyzer where we were able to have a feedback on each child answer. It gave us how many question each child had answered, total of corrected answers, total incorrect, total skipped answers, their score, and their total attempts to answer each game (See Appendix 10).

Overall the children start to build their own awareness database vocabulary and terms to follow and start to implement and connect what they learn through their daily routine as their behavior and feedback that parents and teachers said as an appreciation of the prototype purpose.

4.6. CONCLUSTION

Children with diabetes required education and exercise to help them guide a long and healthy life. They must have high level of awareness of their nutritional needs and how their bodies react to certain foods that might change their level of blood glucose in either good or bad way. Depending on the child's age, many activities will help them gain the education and get the exercise they need.

In this Chapter we propose an E-Learning prototype which could serve as game-based learning method to educate and heighten diabetes awareness of the preschool students in Abu Dhabi, UAE. The requirements was highlighted and guidance by clinicians from MOH, experts curriculum designers from ADEC and KG teachers.

The use of game-based learning is considered a successful approach since the study is directed at preschoolers who take pleasure in learning with games.

Initial results indicated that game-based learning can generate positive learning and motivational attitudes in students, taking less time to complete health desired awareness tasks than traditional methods, making learning more fun, and allowing students to learn at their own pace.

Conclusion & Future Work

The chapter presents an overview of this thesis with the conclusion and possible future extension recommendations. Section 1 is a summary of thesis study, work, and findings that addresses directly the research questions. Section 2 is a conclusion remarks along with the possible future extensions recommendation for the future work that can be done.

5.1. CONCLUSION

This study presents a major problem that UAE and the world is having and a problem that is accelerating. This problem is the rapidly increasing numbers of diabetic people. What is diabetes (RQ2.1)? As Chapter 2 shows in Section (2.1.1) the definition of diabetes was cleared out as a disorder that affect the body way in digesting food for energy and growth. Also the types of diabetes that are well known as the type I, II and gestational diabetes were explained in Section (2.1.2). In addition, Section (2.1.3) discussed how people can develop diabetes. Old days traditional methods were used to educate patients with diabetes (RQ 2.2). Traditional methods on educating patients with diabetes were identified in Chapter 2 Section (2.2) as showing them some pictures and explain to them their disease in specific time and place at the hospital or care center.

Therefore, we need to use and to understanding the technologies in order to help people with diabetes (RQ1). The technologies can help people with offering E-learning techniques which are according to Salvatore (2009) Webinars, E-Learning Modules and Social Networks. All of them to connect people and give them the advantage of transferring and sharing the knowledge see Section (2.3). E-learning technology can increase diabetes awareness (RQ2) by emerging information and communication technologies to improve diabetes care and outcomes. Through

integrating technologies and creating new devices to help the patients see Section (2.3.1). This opens a way to the technologies to reach a promising level in this matter (RQ2.3). Reducing cost and time is granted now with the use of technologies in which is covered in Chapter 2 Section (2.3). The E-Learning technology can be summarized as the following:

- Wrist-Watch Glucose Meters which is a rest watch that is following a non-invasive technique for evaluation of glycemia – see Section (2.3.1.1).
- Facial Expression as an Adaptive Communications Mechanism: to read patients expression especially in old people, very young or even the special needs – see Section (2.3.1.2).
- Global Positioning System Technology: to locate the patients where ever they are–see Section (2.3.1.3).
- Game-based Learning to Helping Children with Diabetes and spread awareness in fun way –see Section (2.3.2).
- Mobile Telephone to Educate Users about Diabetes Self-Management to develop trend in mobile learning for supporting health and relaxation activities – see Section (2.3.3).
- Computer-Aided Learning to carry out the same responsibilities as a human tutor in face-to-face education–see Section (2.3.4) such as the Web-Based Diabetes Advisory System in Section (2.3.4.1), Intelligent Tutoring Systems in Section (2.3.4.2), Tele-care/Telemedicine application in Section (2.3.4.3), and Social Networking Services in Section (2.3.4.4).
- Diabetes Smart/Chip Card which contains a memory, microprocessor and an interface to the outside world- see Section (2.3.5).

Unfortunately, the UAE is suffering from the growing rates of diabetes (RQ2.4). It is the second highest country around the world in diabetes level as what have been found in Chapter 2, Section (2.4). UAE provide knowledge and care centers to all patients beside it also host international conferences as the International Diabetes Summit that been held on Dubai 2010.

As a result a step had to be done to help in reducing the numbers of diabetes in UAE and help them to level up their level of awareness by finding a convenient design of E-Learning system to be used in helping people with diabetes in UAE (RQ3). The convenient design of E-Learning is the game-based learning techniques which were defined in Section (2.3.2). The reason behind choosing the GAME-BASED LEARNING (RG3.1) is that games are becoming more common in teaching contexts as number of studies and the statistics supports the occurrence of game play- see Section (4.1). There are benefits of using GAME-BASED LEARNING (RQ3.1.1) as Section (4.1.1) shows are Motivation, Engagement, Integrating of different cognitive tools in an easy way, Students can learn at their own speed, Learning fun, Positive learning attitudes, and Less time than traditional methods. Whereas, the Challenges for using GAME-BASED LEARNING (RQ3.1.2) as - Section (4.1.2)- which can be overcome are Learner's expectations, Technical issues, Cost, and GAME-BASED LEARNING fantastic ideas and hard to implement.

The study carefully chosen the preschool stage (RQ3.2) children aged between 3-5 years old (KG 1 & 2) whether they are diabetes patients or not. As in Section (4.2) it is vital to begin as early age as possible to reach both parents and children before they have had time to establish incorrect behavior that is more difficult to be change the older the child gets. Also preschooler stage is suitable age (RQ3.3) to initiate the awareness from as the intensive review in Section (4.3) on the suitability of preschooler for computer based learning and from different studies on preschooler and computers Section (4.3.1) we find that preschoolers can control the computers-see Section (4.3.2), using computer can help socializing Section (4.3.3), can ease the way of teaching Section (4.3.5), can develop safe & understandable school environment Section (4.3.6)

To help those kids to understand the right eating habit and increase their awareness I had to use an attractive and efficient method to teach them with. Therefore, some theories (RQ3.4) were invested to help on building a useful prototype. There were two aspects to look at the Learning Theories (i.e. Intrinsic Motivation, Cognitive

Apprenticeship, and Experiential Learning) see Section (4.4.1). The other is Designing Theories (i.e. Media Equation, Discovery Learning, and Guerilla HCI) see Section (4.4.2). Then a system has been designed contained 3 main scenarios that will deal with healthy nutrition, Safe playing guide, and Symptoms diagnose. The findings and result of the study indicate a positive result that shows that the children are responding and developing an understanding of diabetes disease.

5.2. FUTURE WORK

In this research we propose an affective prototype which could serve as an E-Learning or game-base learning method to educate raise diabetes awareness of the preschool students in Abu Dhabi. The use of game-based learning is successful since the study is directed to preschooler who takes pleasure in learning with games (de Freitas, 2006; de Freitas et al., 2006).

After this investigation, the same method proposed can be applied to a different sample of other health issues to see if the results are different. Most of the issues covered in this thesis can be further studied.

The future recommendation is to use the finding of the results to improve the prototype and use it in wider range to track learning outcomes and to confirm that E-Learning methods are faster and better than the traditional methods. Also, it's useful to track the behavior change on the children psychology and eating habits for those who used these kinds of E-Learning methods to know the impact on them. If such studies made it will sum up that game-based learning can generates positive learning attitudes in student, takes less time to do then traditional methods, makes learning fun, student can learn at their own speed and motivate them to learn. Also this study can be expanded in developing these kinds of games to be engaged with physical activates by using for example LCD projector and sensing board that allows the children to use their answers by jumping on them.

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APPENDICES LIST

Appendix 1: EDUCATIONAL SOFTWARE OBSERVATION (For Preschooler)

Appendix 2: INTERVIEW WITH KINDERGARTEN TEACHER

Appendix 3: INTERVIEW WITH DIABETES NUTRITION SPECIALIST

Appendix 4: INTERVIEW WITH CURRICULUM DESIGN EXPERT

Appendix 5: EDUCATIONAL SOFTWARE EVALUATION (For Teachers & Users Parents/Guardian)

Appendix 7: IEEE Paper " Using E-Learning for Helping Children with Diabetes"

Appendix 8: 24th March 2011 - eHealth Symposium Program.

Appendix 9: Screen shots of the web page prototype on stage 2.

Subject #:-----

Date:-----

Appendix 1: EDUCATIONAL SOFTWARE OBSERVATION (For Preschooler)

Socio-emotional Development

- | | |
|--|--------|
| 1. Teacher or instructor introduces the subject to the users. | Yes/No |
| 2. Their interest does not decrease through playing | Yes/No |
| 3. Students share answers. | Yes/No |
| 4. Demonstrates confidence in self and can work independently. | Yes/No |

Physical Development

- | | |
|---|--------|
| 5. Is developing eye-hand coordination | Yes/No |
| 6. Is developing sensory awareness | Yes/No |
| 7. They are interacting with the system | Yes/No |

Intellectual Development

- | | |
|--|--------|
| 8. developing a positive attitude towards learning | Yes/No |
| 9. using language to bring meaning to what is learnt | Yes/No |
| 10. Is developing logical thinking skills through a variety of activities as classifying, organizing, matching... etc. | Yes/No |
| 11. Is listening for information, directions, and explanations. | Yes/No |
| 12. They can understand the vocabulary | Yes/No |
| 13. They understand their answers | Yes/No |
| 14. They can know if their answer is right or wrong | Yes/No |

Software evaluation Performance

- | | |
|---|--------|
| 15. They are interested on the system | Yes/No |
| 16. They can go back to re-answer the wrong answers | Yes/No |
| 17. The font is suitable | Yes/No |

Comments

Appendix 2: Interview with Kindergarten Teacher

Interview with _____

Date: _____

Time: _____

Note: _____

Q1. Is there is any health awareness you teach to children in the KG?

Q2. What is the main focus at this moment regarding introducing the healthy nutrition?

Q3. Is there is any activity you have to maintain the knowledge?

Q4. Are there any computer activities you are using to engage fun and learning to kids at this age?

Q5. How basic is the language you are using to teach the kids about the health nutrition?

Appendix 3: Interview with Diabetes Nutrition Specialist

Interview with _____

Date: _____

Time: _____

Notes: _____

Q1. What is the best age to start awareness to children?

Q2. Do you have any activities to the children to teach them such information?

Q3. Are there any symptoms that you can teach the children to be aware of?

Q4. How about how they take care of their foot and body during playing?

Q5. What sort of food do you recommend them to eat?

Appendix 4: Interview with Curriculum Design Expert

Interview with _____

Date: _____

Time: _____

Notes: _____

Q1. Is the health education supported by Abu Dhabi Education Council?

Q2. Is the health awareness part of the preschool curriculum in Abu Dhabi Education Council?

Q3. What sort of activities that preschooler uses to achieve this awareness?

Q4. Have you ever conceder the use of technology as a tool of learning in the preschool stage?

Appendix 5: Educational Software Evaluation (For Teachers/ Parents/Guardian)

Rating Code: 5-excellent 4-good 3-satisfactory 2-fair 1-poor

Educational Value and Pedagogy

1) Program is flexible for intended user(s)	5 4 3 2 1
2) The level of the program language is suitable for preschooler	5 4 3 2 1
3) The grammar and vocabulary used in the program are accurate.	5 4 3 2 1
4) It can be easily starting the program	5 4 3 2 1
5) The user interface easily can be understand	5 4 3 2 1
6) The program pictures are they (a) relevant, (b) an aid to understanding.	5 4 3 2 1
7) Navigation is easy through the program	5 4 3 2 1
8) If scoring system is used, does it encourage the learner?	5 4 3 2 1
9) The learner offered useful feedback if s/he gets something wrong.	5 4 3 2 1
10) Appropriate for classroom setting	5 4 3 2 1
11) Meets relevant educational needs and relevant to the curriculum	5 4 3 2 1
12) New terms are defined	5 4 3 2 1
13) Student has chance to correct errors	5 4 3 2 1
14) Material is presented clearly and interestingly	5 4 3 2 1
15) Follows progression of skills	5 4 3 2 1
16) Student advances at appropriate speed	5 4 3 2 1

Effective Use of Computer

Rating Code: 5-Strongly Agree 4-Agree 3-Disagree 2-Strongly Disagree 1- Neutral

1) Computer software is more effective/efficient than other methods	5 4 3 2 1
2) Game display is pleasing and functional	5 4 3 2 1
3) Audio is effective if its available	5 4 3 2 1

The 2011 Health Informatics Research Workshop @ Liverpool Hope University

Date: Thursday, 24th March 2011

Time: 9.30am – 4.30pm

Venue: Conference Centre, Liverpool Hope University, Hope Park, Liverpool

Summary

Recent advances in ICT have enabled new forms of e-collaboration, multi-dimensional data analysis, integrated e-solutions and easy-to-use human-centred interfaces that can be potentially applied to improve healthcare services delivery. However, the visions of e-health portend far-reaching challenges to researchers in HCI and innovative knowledge-based information systems of the future. This workshop seeks address some of these challenges in relation to issues of knowledge support, cross-boundary collaboration, usability and user-centredness.

Workshop Programme

09.30 – 9.45	Registration and Coffee
9.45 – 10.00	Welcome Dr John Brinkman Dean, Faculty of Sciences and Social Sciences, Liverpool Hope University
10.00 – 10.30	Opening Talk Nia Pendleton-Watkins Programme Manager, Informatics Skills Development NHS North West
10.30 – 11.25	Data Mining Techniques for Optimal Patient Treatment Recommendations in Health Decision Support Dr Shang-Ming Zhou Centre for Health Information Research & Evaluation (CHIRAL) School of Medicine, Swansea University
11.25 – 11.40	Coffee Break
11.40 – 12.30	Evaluation in Health Technology Projects Dr Farath Arshad Centre for Health & Social Care Informatics (CHaSCI), Liverpool John Mores University
12.30 – 13.30	Lunch
13.30 – 14.00	A Parallel System for the Classification of Cancerous and Normal Tissue Images Dr Saad Amin Faculty of Informatics, British University in Dubai
14.00 – 14.50	Practice-based Distributed Decision Support in Cross-Boundary E-Health Obinna Anya Department of Computer Science, Liverpool Hope University
14.50 – 15.10	Coffee Break
15.10 – 16.00	A Technology Acceptance Model for E-Health Abdul Hakim Mohammed Department of Computer Science, Liverpool Hope University
16.00 – 16.30	A Game-based Learning Approach for Awareness of Diabetes: A Study of UAE Children Mona Ali Al-Mansoori Faculty of Informatics, British University in Dubai
16.30	Closing Remarks

For more information, registration and attendance, please contact workshop organisers:

Dr Hissam Tawfik, Liverpool Hope University, UK, +44 151 291 3168, tawfikh@hope.ac.uk

Prof Atulya Nagar, Liverpool Hope University, UK, +44 151 291 3930, nagara@hope.ac.uk

Obinna Anya, Liverpool Hope University, UK, +44 151 291 3920, 08009472@hope.ac.uk

This event is part of the British Council funded Project on Context-Aware Information Systems for E-Health Decision Support. For details, visit: http://hopelive.hope.ac.uk/imc/research/e_health/projects/summary.html



Using E-Learning for Helping Children with Diabetes

Mona Al-Mansoori, Khaled Shaalan

Department of Informatics

Faculty of Engineering and IT

British University in Dubai

Dubai, UAE.

Hissam Tawfik

Department of Computer Science

Faculty of Science and Social Sciences

Liverpool Hope University

Liverpool, UK.

Abstract—Diabetes is a common and costly condition disease that is associated with significant morbidity and mortality. Recent studies have shown remarkable increases in diabetes during the last decade. This has attracted many researchers and doctors to investigate e-learning technologies as a way of assisting people with diabetes. However very little work exist that focus on educating children to adopt healthy lifestyle. As a result, this research work aims to create awareness of diabetes among children, and thereby, ultimately contribute to reducing the growing rate of diabetes. This paper presents an investigation into E-Learning systems and how it can help people with diabetes, especially when it comes to children who are largely unaware and poorly informed about the menace of the disease. This research addresses children' needs expectations, and proposes a design of an E-Learning prototype that can raise their awareness and knowledge in order to help reduce the effects of this disease on children.

Keywords- *E-Learning; Game-based Learning; Diabetes.*

I. Introduction

This work focuses at designing an E-Learning prototype that can help children with the diabetes disease by raising their awareness and helping them

control the increasing number of the disease. The research is testing the use of E-Learning system among children, parents or (guardians) and teachers. Through observations, evaluations, interviews, and evaluations, findings are analyzed to develop and feed into developing the initial prototype.

The motivation for this research study comes from the recent emphasis on healthy lifestyles and the limited research in the area of whether educational information is contained and incorporated in game play strategies can be considered as a motivation also for this study. Recent studies have found remarkable increases in diabetes during the last decade. More than 220 million people worldwide have diabetes and in 2005, an estimated 1.1 million people died from diabetes and almost 80% of diabetes deaths occur in low-and middle-income countries. In the case of United Arab Emirates (UAE) there is about 20% of the population who has diabetes (11).

This paper aims to explore the potential E-Learning to help children with diabetes in raising their awareness and attempt to slow down the growing number of people contracting this disease, or at least work against the negative or bad

consequences. Our investigation has been informed by feedback received from diabetes nutrition specialist, clinicians, curriculum expert designer, and KG teachers regarding the best way to facilitate the communication among people with diabetes and their dependents; identifying the best age group within which to initiate this project, and promoting improved understanding by children and teachers in the foundation phase of their peers that may suffer from diabetes.

II. Related Work

E-Learning has been found to reduce general cost and time, as found by Brandon Hall (12). E-Learning can cover the regular delivery of content by asynchronous, self-paced E-learning. Studies support computer-based education as a successful strategy for transferring knowledge and skill development for patients (17). Some E-Learning techniques like Webinars are using mobile telephone to educate users about diabetes self-management by short message service (SMS) (i.e. MPro Care, Diabetes phone, Emminens Service). Another technique is the E-Learning modules such as the Web-Based Diabetes Advisory Systems (i.e. AIDA, DiasNet, DIABETEX, and DEMS), Intelligent Tutoring Systems (i.e. CAL System, DIABLOG, and IDEATel), and Telecare/Telemedicine applications (i.e. DIABTel, M2DM, and T-IDDM Project) (11). In addition to that, Social networks, such as Twitter, blogs, Second Life worlds, LinkedIn groups, and similar web-based social applications all offer immediate and effective experiences that keep patients connected to the real world. Virtual medical offices and hospitals are used to provide training, and to simplify patient experience for example the LibraryThing Medicine Group,

MySpace 'CURE DiABETES group' run by patients and supporters (1) (11).

There is also growing evidence that emerging information and communication technologies can assist in diabetes care and outcomes. Some of those techniques are Wrist-Watch Glucose Meters (Tura), Facial Expression as an Adaptive Communications Mechanism (19), Global Positioning System Technology, and Diabetes Smart/Chip Card (9).

Game-based learning is considered as an efficient way to teach users. This means has been used to study learning (4) and selective attention (5) in children, to inspect memory processes in college students (21), to improve neuropsychological parameters in the elderly (8), to improve attention span in children with attention deficit/hyperactivity disorder (20), to teach database design concepts (7), and to ease children undergoing chemotherapy (16).

However, the main focal point has been science advancement or therapeutic purposes. Whereas some game-based learning systems have been developed for health support and educational uses (18), such as helping children with diabetes learn how to manage their disease (6), most use clear methods. That is the subjects are aware of the purpose and goal of the game. To the best of our knowledge, little research is on hand whereby educational information is contained and incorporated in game play strategies (10).

Some diabetes awareness-raising games have been used successfully for children but have mainly targeted children at school age such as "Egg breeder, Detective, Buildup Blocks" (2), "Insulot" (2), and "Packy & Marlon" (6). In our research we are targeting preschool children who are between 3 and 5 years old. Studies show that children develop many

food attitudes, behaviors, and preferences during their preschool years (3). Kauffer- Christoffe (15) proves that early timing as she said that the "*...window of opportunity for prevention is not long...*". Healthy eating habits are essential for the usual development and growth of preschool children and to stop nutrition related diseases later in life.

III. User Requirements for an E-Learning initial prototype design

The aim of this research is to design an appropriate E-Learning prototype that can help to raise awareness among children whether they have the disease or not in order to educate them that they receive a minimum level of required knowledge by interviewing Kindergarten teachers, curriculum designer experts of the taught curriculum in UAE, and diabetes nutrition specialist.

Interviews were held with Kindergarten teachers from Abu Dhabi, UAE, to identify if there is any health awareness taught to the children and how they introduce such awareness in a simple and attractive way. The interview questions also sought to identify the activities to maintain such knowledge and if there is any technology involved in these procedures. Other interviews were with consulted curriculum designer experts in Abu Dhabi's Education Council (ADEC), UAE, to ensure that the proposed game follows and achieves the ADEC Standards of the Ministry of Education (MoE) in UAE. The rationale behind the interview questions was to determine to what extend is ADEC supporting health education and if it is a part of the preschool curriculum. In addition, how the activities are designed for students to achieve such awareness and with what type of technology. Also, there were interviews with diabetes nutrition specialist and clinicians from the Ministry of Health

in Abu Dhabi, UAE, to gain a better understanding of the correct nutritional items for this age group. The interview questions were designed to identify an appropriate age to start raising awareness for children and what kind of activities can be used to teach the children such information. Furthermore, the interview questions help us to capture symptoms that can be taught to the children to make them aware of their body system and how they can take care of their bodies. Also the nutrition interview questions were looking for the way that nutrition is used on recommendation and promoting good food habits to children.

Table 1 provides information about the assessment tools that have been used to capture the user requirements of the prototype. It also covers the target user for each tool and the target area that the tool identifies in each assessment.

The requirements that have been captured through the interviews indicated the needs for developing an E-Learning system that will help children develop healthy lifestyle and understand the need for healthy food choices. Also, they need to know the food categories and identify the different kinds of food that they are eating. Safe playing guides list that can help the children to protect their selves and others as well from danger by developing the right behavior such as fire safety and traffic safety. Moreover, the diabetes symptoms that the children need to be aware of to know what diabetes are and how it work.

IV. Initial Prototype

Task requirements for our proposed system prototype have been identified in the form of storyboards that consist of three main scenarios to deal with: Healthy nutrition, safe playing guide, and symptoms diagnose.

1. Health Awareness.

Nutritional Awareness: The game concept is “Drag & Drop”. This game helps to develop awareness of the child to understand what healthy food is and what the unhealthy food is by grouping the group of healthy food together and the unhealthy food together as snapshot figure 2-3 shows. This will develop the healthy food habits as snapshot Figure 1 shows.

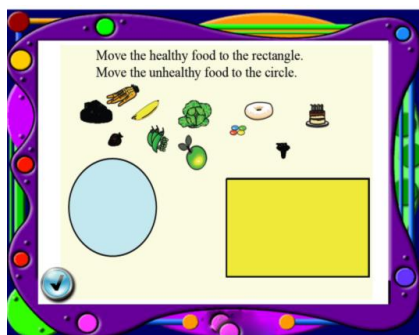


FIGURE 2: DROP & DRAG

Food Pyramid: The story of the game is “Match the food”, where children will identify the food categories that will help them to understand how much their body needs by matching each food to its category as snapshot Figure 2 shows. This game will develop healthy food habits.

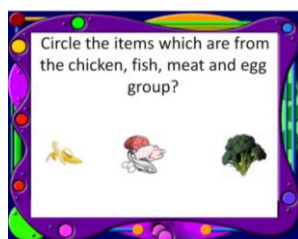


FIGURE 2: FOOD PYRAMID

2. Playing & Safety Awareness Games targets the safety.

Playing Safely: The story of the game is “What’s Wrong?”, where the child learns the correct

behavior and identifies the wrong behavior by selecting appropriate pictures as snapshot Figure 3 shows.



FIGURE 3: PLAYING SAFE

Fire Safety: The story of the game is “Is it Good or Bad?”, where child is introduced to fire safety and understands how to avoid fires and what might cause a fire by selecting appropriate pictures as snapshot Figure 4 shows.



FIGURE 4: FIRE SAFETY

Traffic Safety: The story of the game is “Traffic lights”, where child introduced to the traffic lights colors – matching the correct color of light with the right sign by selecting appropriate pictures as snapshot Figure 5 shows.



FIGURE 5: TRAFFIC SAFETY

3. Diabetes Awareness Games.

Diabetic Diagnoses: The story of the game is “Are you Diabetic?”, where a child will know

the symptoms of a diabetic on others and compares himself/herself with them by determining whether or not s/he has the symptoms as snapshot Figure 6 shows.



FIGURE 6: DIABETIC DIAGNOSES

Bank of Information: The story of the game is “Give me answer; Take a Golden Coin”, where a child will know that what he eats goes to the stomach and break down into a simple sugar called glucose, which is his body's main source of fuel. The glucose passes into his bloodstream, where a hormone called insulin helps the body's cells use the glucose for growth and energy and if the insulin is not available the cell will not get any glucose. They will know also that insulin is produced by the pancreas behind the stomach. In a healthy body, the pancreas automatically produces the amount of insulin needed to move the glucose from the blood into the cells. They will learn this by a game that will give a golden coin for each right answer as snapshot Figure 7 shows.

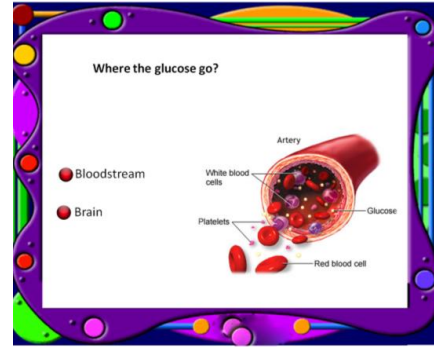


Figure 7: Bank of Information

Integrating a variety of tools altogether has been one of the biggest challenges for E-learning, as often tools that have possible uses for learning are not always as simply integrated into educational systems (14). Also, technical restrictions, such as firewalls, the graphics capability of available PCs, memory size, can often make ready access to new tools hard. However, game-based learning does offer the achievable to integrate different cognitive tools and any computer can easily work out with the proposed prototype.

V. Experimental scenario and results

The first design stage is an initial prototype that will start with small sample using nine children from three different kindergartens in Abu Dhabi, UAE. Table 2 shows the breakdown of participants according to their gender and age.

Table 2: Distribution of Experiment Participants

KG in Abu Dhabi	Total	Male	Female	Age in yrs		
3	9	4	5	3	3	3

In addition, the evaluation of the KG teachers, parents or (guardians) of the users and the nutrition specialist will be another mean of evaluation. Then, using the results of the test, a second story board will be created. The results from the second storyboard

will determine the final design platform of the storyboard and thus the design becomes an iterative process that will use bigger sample at the end.

Program quality assessment tools have been used to assess the quality of the E-Learning initial prototype. Because of the young age of the users, evaluation was based on observation and analysis by people who are able to make expert judgment (i.e. User parents or (guardians), KG teachers, and researcher). These tools include observations of the use of the prototype program, and evaluating the prototype by academic staff and parents or (guardians) to implement the required improvements. Table (3) provides information about the assessment tools that have been used during the evaluation phase of the prototype. It also covers the target user for each tool and the target area that the tool identifies in each assessment.

The following section presents the outcome of the initial prototype. The evaluation of the prototype in this study was carried out by observing the potential users and how they deal with the initial prototype and their reaction towards it to evaluate the prototype. The aim behind observation was to evaluate some aspect of the *socio-emotional*, *physical development*, *intellectual development*, and *software evaluation performance*. Through observation the children shows a positive achievement in Socio-emotional Development, Physical Development, and Intellectual Development. However, in the Software evaluation Performance the achievement was only 67% since the children could not go back to re-correct their mistakes. As shown in Figure (7).

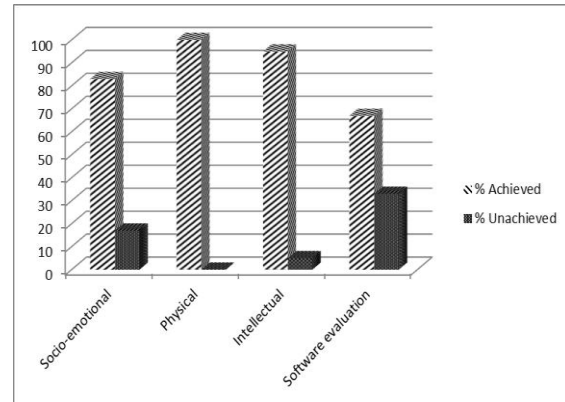


FIGURE 7: THE SATISFACTION PERCENT OF THE SOFTWARE PERFORMANCE OBSERVATION.

The evaluation was directed towards the KG teachers, experts, and parents or (guardians) expectation in order to improve the prototype and the information criteria cover the prototype relevance to users, language, organization of information, and information quality aspects of the program.

The evaluation of the KG teachers, parents or (guardians), and nutrition specialist shows that the educational value and pedagogy aspects that the prototype exceed in its first stage 75% excellent, 13% good, 6% satisfactory and 6% poor performance. While the aspects related to usefulness of computer based-learning was 100% strongly agreed, where it evaluated the computer effective/efficient than other methods, game display is pleasing and functional and audio is effective if it's available as Table 4 shows.

TABLE 3: EVALUATION RESULT OF THE KG TEACHERS, PARENT OR (GUARDIANS), AND NUTRITION SPECIALIST.

	Excellent	Good	Satisfactory	Fair	Poor
Aspects related to Educational Value and	75%	13%	6%	0%	6%

Pedagogy					
Aspects related to Usefulness of Computer Based-Learning	100%	0%	0%	0%	0%

The main suggestions for improvements and research findings highlighted the needs of navigation mechanism in order that the children can learn from their mistakes with audio sound and develop a mechanism to keep a record of each child experience to track the improvement and learning that has been made.

VI. Conclusion

In this paper we propose an E-Learning prototype which could serve as game-based learning method to educate and raise diabetes awareness of the preschool students in the UAE. The requirements and guidelines were gathered and informed by clinicians from MOH, curriculum designer experts from ADEC and KG teachers. The use of game-based learning is considered a successful approach since the study is directed at preschoolers who take pleasure in learning with games.

Initial prototype evaluation results indicated that game-based learning can generates positive learning

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and motivational attitudes in children, taking less time to complete awareness tasks compared to traditional methods, making learning more fun, and allowing children to learn at their own pace. Future work will include the use of larger sample size for the development and evaluation of the prototype.

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TABLE (1): Initial Prototype Assessment Tools for Capturing the User Requirements

Assessment Tool	Target User	Purpose	Target Areas	
Interview with kindergarten teachers	<ul style="list-style-type: none"> KG Teachers in Abu Dhabi 	<ul style="list-style-type: none"> Improvement Research 	<ul style="list-style-type: none"> Learning environment Teacher/Child interactions Teacher supports Engaging environments 	<ul style="list-style-type: none"> Effective curricula Language development Teacher/Child interactions Program structure Awareness Activities
Interview with diabetes nutrition specialists	<ul style="list-style-type: none"> Nutrition Specialist 	<ul style="list-style-type: none"> Improvement Research 	<ul style="list-style-type: none"> Health Awareness Nutritional awareness 	<ul style="list-style-type: none"> Safety awareness Awareness Activities
Interview with curriculum designer experts	<ul style="list-style-type: none"> Curriculum Designer in ADEC 	<ul style="list-style-type: none"> Improvement Research 	<ul style="list-style-type: none"> Curriculum methods Engaging environments Effective curricula Program structure 	<ul style="list-style-type: none"> Administration-Teacher communication Child development curriculum

TABLE (3): Initial Prototype Assessment Tools for Evaluating the Prototype

Assessment Tool	Target User	Purpose	Target Areas	
Educational Software Observation	<ul style="list-style-type: none"> Potential users – preschooler age (3-5 years) 	<ul style="list-style-type: none"> Improvement Evaluation Monitoring 	<ul style="list-style-type: none"> Interacting Health awareness Nutritional awareness 	<ul style="list-style-type: none"> Teacher/Child interactions Behavior

			<ul style="list-style-type: none"> • Safety awareness • Language interaction • Social development • Emotional development 	<ul style="list-style-type: none"> • Acceptance of child • Variety of skills used. • Learning outcomes • Physical development • Intellectual development
Educational Software Evaluation	<ul style="list-style-type: none"> • Teachers • Users parents or (guardians) 	<ul style="list-style-type: none"> • Improvement • Evaluation 	<ul style="list-style-type: none"> • Parent involvement • Staff involvement. • Teacher supports • Computer effectiveness. 	<ul style="list-style-type: none"> • Learning outcomes • Teacher-parent communication • Computer efficiency. • Educational value.

Appendix 8: The Seventh International Conference on Innovations in Information Technology (April 25-27, 2011, Abu Dhabi and Al Ain, UAE)



Tuesday, April 26

Registration

Light Breakfast

Security in Intelligent Transportation Systems

Prof. Abderrahim Benslimane, University of Avignon, France

Innovative Services for a Smarter Planet

Dr. David L. Cohn, Program Director, Smarter Cloud, IBM T. J. Watson Research Center, Yorktown Heights, New York

(E-Health)

e-HTAM: a Technology Acceptance Model for Electronic Health

Abdul Hakim H. M. Mohamed (Liverpool Hope University, United Kingdom); Hissam Tawfik (Liverpool Hope University, United Kingdom); Dhiya Al-Jumeily (Liverpool John Moores University, United Kingdom)

Evaluation in Health Technology Projects

Farah Arabad (Liverpool John Moores University, United Kingdom)

Using E-Learning for Helping Children with Diabetes

Mona Al-Mansoori (British University in Dubai, UAE); Khaled F. Shaalan (The British University in Dubai (BUID), UAE); Hissam Tawfik (Liverpool Hope University, United Kingdom)

Cross-Boundary Knowledge-based Decision Support in e-Health

Obinna Anya (Liverpool Hope University, United Kingdom); Hissam Tawfik (Liverpool Hope University, United Kingdom); Atulya K Nagar (Liverpool Hope University, United Kingdom)

Lunch

Computational epidemiology: a new paradigm in the fight against infectious diseases

Prof. Vittoria Colizza, ISI Foundation, Turin, Italy

Coffee Break

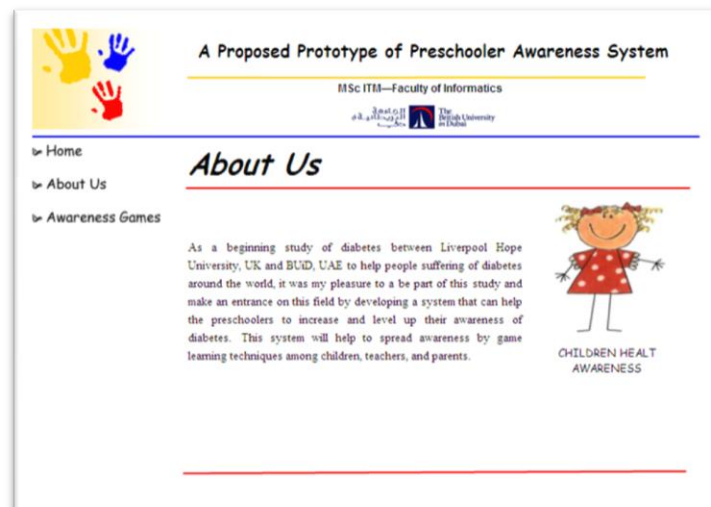
The Evolved Packet System

Dr. Tarik Taleb, NEC Europe Ltd.

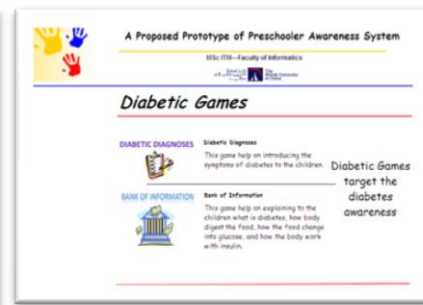
Appendix 9: Screen Shots of the Web Page Prototype on Stage 2



The “Home” page of the prototype system.



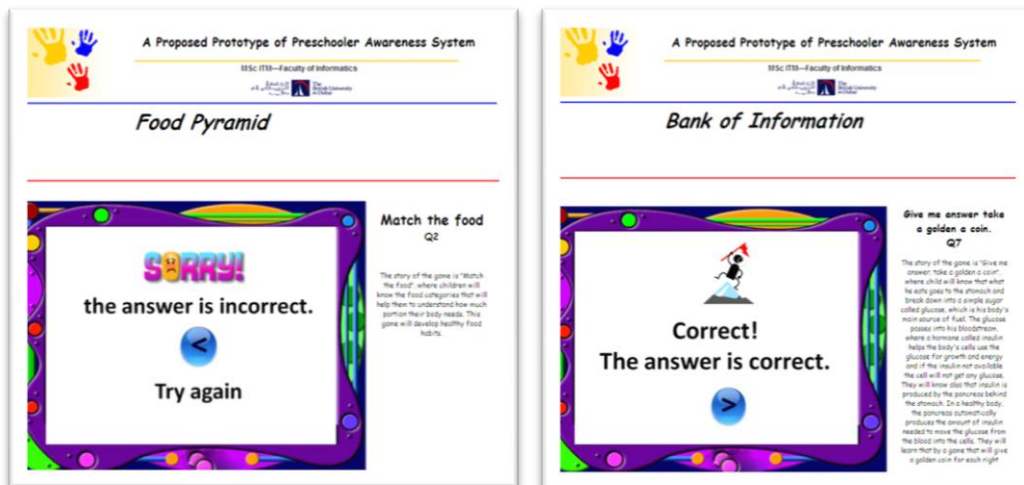
The “About Us” page



The awareness games containing the three scenarios.



The beginning of each game with instruction how to play



Users can navigate between the games with a sound effects for each result.

Appendix 10: Screen Shots of the Adobe Captivate 5 Quiz Result Analyzer

Adobe Captivate Quiz Results Analyzer

Source: From this Computer Browse

Organization: moon Department: gameBased Course: RUDIabetic Lesson: RUDIabetic

moon > gameBased > RUDIabetic > RUDIabetic >

Sl. No.	Leamers	Result-All	Total Question A	Total Correct	Total Incorrect	Total Skipped	Score	Total Attempts
1	Ali Abdullah	passed	0	0	0	10	90	2
2	Amna Khaled	passed	0	0	0	10	90	1
3	Eid majed	passed	0	0	0	10	50	1
4	Fatima kames	passed	0	0	0	10	90	1
5	f	passed	0	0	0	10	80	1
6	Hasabi Sayah	passed	0	0	0	10	60	2
7	Kholoud Abdulla	passed	0	0	0	10	90	1
8	Latifa Ebrahim	passed	0	0	0	10	90	1
9	Maha Saeed	passed	0	0	0	10	80	1
10	Mahra Mohamm	passed	0	0	0	10	90	1
11	Mariam Mohamr	passed	0	0	0	10	90	1
12	Maryam Zayed	passed	0	0	0	10	90	1
13	Mater Kames	passed	0	0	0	10	70	1
14	Mohammed Ali	passed	0	0	0	10	90	2
15	Moza Ali	passed	0	0	0	10	90	1
16	Naseer Jasim	passed	0	0	0	10	90	1
17	Noura Hamad	passed	0	0	0	10	90	1
18	Sara Rashid	passed	0	0	0	10	90	2
19	Sayah Humid	passed	0	0	0	10	60	1
20	Shamma Salem	passed	0	0	0	10	90	1

* Double click the rows to dig down the data.

Adobe Captivate Quiz Results Analyzer

Source: From this Computer Browse

Organization: moon Department: gameBased Course: BankOfInfo Lesson: BankOfInfo

moon > gameBased > BankOfInfo > BankOfInfo >

Sl. No.	Leamers	Result-All	Total Question A	Total Correct	Total Incorrect	Total Skipped	Score	Total Attempts
1	Ali Abdullah	completed	7	6	1	0	60	1
2	Amna Khaled	completed	7	7	0	0	70	1
3	Eid majed	completed	7	7	0	0	70	1
4	Fatima kames	completed	7	6	1	0	60	1
5	Hasabi Sayah	completed	7	7	0	0	70	2
6	Humaid Sayah	completed	7	7	0	0	70	1
7	Kholoud Abdulla	completed	7	7	0	0	70	1
8	Latifa Ebrahim	completed	7	7	0	0	70	1
9	Maha Saeed	completed	7	7	0	0	70	1
10	Mahra Mohamm	completed	7	7	0	0	70	1
11	Mariam Mohamr	completed	7	6	1	0	60	1
12	Maryam Zayed	completed	7	6	1	0	60	2
13	Mater Kames	completed	7	6	1	0	60	1
14	Mohammed Ali	completed	7	7	0	0	70	1
15	Moza Ali	completed	7	7	0	0	70	1
16	Naseer Jasim	completed	7	7	0	0	70	1
17	Noura Hamada	completed	7	7	0	0	70	1
18	Sarah Rashid	completed	7	6	1	0	60	1
19	Sayah Humid	completed	7	6	1	0	60	1
20	Shamma Salem	completed	7	7	0	0	70	1

* Double click the rows to dig down the data.

Adobe Captivate Quiz Results Analyzer

Source: From this Computer

Organization: moon Department: gamesBased Course: DragDrop Lesson: DragDrop

moon > gamesBased > DragDrop > DragDrop >

Sl. No.	Leamers	Result: All	Total Question A	Total Correct	Total Incorrect	Total Skipped	Score	Total Attempts
2	Amna Khaled	completed	3	3	0	0	30	1
3	Eid majed	completed	3	3	0	0	30	1
4	Fatima Khamis	completed	3	3	0	0	30	1
5	hasabi Sayah	completed	3	2	1	0	20	2
6	Humaid Sayah	completed	3	3	0	0	30	1
7	Kholood Abdulla	completed	3	3	0	0	30	1
8	Maha Seed	completed	3	3	0	0	30	1
9	Mariam Mohamr	completed	3	3	0	0	30	1
10	Mater Kames	completed	3	3	0	0	30	1
11	Mohammed Ali	completed	3	3	0	0	30	1
12	Moza Ali	completed	3	3	0	0	30	1
13	Naser Jasim	completed	3	3	0	0	30	1
14	Noura Hamad	completed	3	3	0	0	30	1
15	rtit	passed	3	3	0	0	30	1
16	Sara Rashid	completed	3	3	0	0	30	1
17	Sayah Humid	completed	3	2	1	0	20	1
18	Shamma Salem	completed	3	3	0	0	30	1
19	Shika Ali	completed	3	3	0	0	30	1
20	test001	completed	3	3	0	0	30	3
21	test01	completed	3	3	0	0	30	1

* Double click the rows to dig down the data.

Adobe Captivate Quiz Results Analyzer

Source: From this Computer

Organization: moon Department: gamesBased Course: FireSafety Lesson: FireSafety

moon > gamesBased > FireSafety > FireSafety >

Sl. No.	Leamers	Result: All	Total Question A	Total Correct	Total Incorrect	Total Skipped	Score	Total Attempts
1	Ali Abdullah	completed	3	3	0	0	30	1
2	Amna Khaled	completed	3	3	0	0	30	1
3	Eid majed	completed	3	3	0	0	30	1
4	Fatima Kames	completed	3	2	1	0	20	1
5	f	completed	3	3	0	0	30	1
6	Hasabi Sayah	completed	3	3	0	0	30	2
7	Khouid Abdullah	completed	3	3	0	0	30	1
8	Latifa Ebrahim	completed	3	3	0	0	30	1
9	Maha Saeed	completed	3	3	0	0	30	1
10	Mahra Mohamm	completed	3	3	0	0	30	1
11	Mariam Mohamr	completed	3	3	0	0	30	2
12	Mater Kames	completed	3	3	0	0	30	1
13	Mohammed Ali	completed	3	3	0	0	30	1
14	Moza Ali	completed	3	3	0	0	30	1
15	Naseer Jasim	completed	3	3	0	0	30	1
16	Noura Hamad	completed	3	3	0	0	30	1
17	Sara Rashid	completed	3	3	0	0	30	1
18	Sayah Humid	completed	3	3	0	0	30	1
19	Shamma Salem	completed	3	3	0	0	30	1
20	Shika Ali	completed	3	3	0	0	30	2

* Double click the rows to dig down the data.

Adobe Captivate Quiz Results Analyzer

Source: **From this Computer** **Browse**

Organization: **moon** Department: **gamesBased** Course: **FoodPyramid** Lesson: **FoodPyramid**

moon > gamesBased > FoodPyramid > FoodPyramid >

Sl. No.	Learners	Result: All	Total Question A	Total Correct	Total Incorrect	Total Skipped	Score	Total Attempts
1	Ali Abdullah	completed	3	3	0	0	30	1
2	Amina Khaled	completed	3	3	0	0	30	1
3	Eid majed	completed	3	3	0	0	30	1
4	Fatima kames	completed	2	2	0	1	20	2
5	hasabi Sayah	completed	3	3	0	0	30	2
6	Khoulood Abdulla	completed	3	3	0	0	30	1
7	Latifa Ebrahim	completed	3	3	0	0	30	1
8	Maha Saeed	completed	3	3	0	0	30	1
9	Mahra Mohamm	completed	3	3	0	0	30	1
10	Mariam Mohamr	completed	3	3	0	0	30	2
11	Mater Kames	completed	3	3	0	0	30	1
12	Mohammed Ali	completed	3	3	0	0	30	1
13	Moza Ali	completed	3	3	0	0	30	1
14	Naseer Jasim	completed	3	3	0	0	30	1
15	Noura Hamad	completed	3	3	0	0	30	1
16	Sara Rashid	completed	3	3	0	0	30	1
17	Sayah Humid	completed	3	3	0	0	30	2
18	Shamma Salem	completed	3	3	0	0	30	1
19	Shika Ali	completed	3	3	0	0	30	1
20	test01	completed	3	3	0	0	30	1

* Double click the rows to dig down the data.

Adobe Captivate Quiz Results Analyzer

Source: **From this Computer** **Browse**

Organization: **moon** Department: **gamesBased** Course: **PlayingSafety** Lesson: **PlayingSafety**

moon > gamesBased > PlayingSafety > PlayingSafety >

Sl. No.	Learners	Result: All	Total Question A	Total Correct	Total Incorrect	Total Skipped	Score	Total Attempts
1	Ali Abdullah	completed	3	3	0	0	30	1
2	Amina Khaled	completed	3	3	0	0	30	1
3	Eid majed	completed	3	2	1	0	20	1
4	Fatima kames	completed	3	2	1	0	20	1
5	hasabi Sayah	completed	3	3	0	0	30	2
6	Khoulood Abdulla	completed	3	3	0	0	30	1
7	Latifa Ebrahim	completed	3	3	0	0	30	1
8	Maha Saeed	completed	3	3	0	0	30	1
9	Mahra Mohamm	completed	3	3	0	0	30	1
10	Mariam Mohamr	completed	3	3	0	0	30	2
11	Mater Kames	completed	3	1	2	0	10	1
12	Mohammed Ali	completed	3	3	0	0	30	1
13	Moza Ali	completed	3	3	0	0	30	1
14	Naseer Jasim	completed	3	3	0	0	30	1
15	Noura Hamad	completed	3	3	0	0	30	1
16	Rodha Ghaleb	completed	3	3	0	0	30	1
17	Sara Rashid	completed	3	3	0	0	30	1
18	Sayah Humid	completed	3	3	0	0	30	1
19	Shamma Salem	completed	3	3	0	0	30	1
20	Shika Ali	completed	3	1	2	0	10	1

* Double click the rows to dig down the data.

Adobe Captivate Quiz Results Analyzer

Source: **From this Computer** **Browse**

Organization: **moon** Department: **gamesBased** Course: **TrafficSafety** Lesson: **FireSafety**

moon > gamesBased > FireSafety > FireSafety >

SL No.	Learners	Result-All	Total Question A	Total Correct	Total Incorrect	Total Skipped	Score	Total Attempts
1	Ali Abdullah	completed	3	3	0	0	30	1
2	Amna Khaled	completed	3	3	0	0	30	1
3	Eid majed	completed	3	3	0	0	30	1
4	Fatima kames	completed	3	2	1	0	20	1
5	f	completed	3	3	0	0	30	1
6	Hasabi Sayah	completed	3	3	0	0	30	2
7	Khould Abdullah	completed	3	3	0	0	30	1
8	Latifa Ebrahim	completed	3	3	0	0	30	1
9	Maha Saeed	completed	3	3	0	0	30	1
10	Mahra Mohamm	completed	3	3	0	0	30	1
11	Mariam Mohamr	completed	3	3	0	0	30	2
12	Mater Kames	completed	3	3	0	0	30	1
13	Mohammed Ali	completed	3	3	0	0	30	1
14	Moza Ali	completed	3	3	0	0	30	1
15	Naseer Jasim	completed	3	3	0	0	30	1
16	Noura Hamad	completed	3	3	0	0	30	1
17	Sara Rashid	completed	3	3	0	0	30	1
18	Sayah Humid	completed	3	3	0	0	30	1
19	Shamma Salem	completed	3	3	0	0	30	1
20	Shika Ali	completed	3	3	0	0	30	2

* Double click the rows to dig down the data.

TABLES LIST

TABLE 3.1: PROTOTYPE ASSESSMENT TOOLS

TABLE 4.2: LEARNING THEORIES

TABLE 4.3: DESIGNING THEORIES

TABLE (3.1): PROTOTYPE ASSESSMENT TOOLS

	Assessment Tool	Target User	Purpose	Target Areas
Capturing the User Requirements	Interview with kindergarten teacher	<ul style="list-style-type: none"> • KG Teachers in Abu Dhabi 	<ul style="list-style-type: none"> • Improvement • Research 	<ul style="list-style-type: none"> • Learning environment • Teacher/Child interactions • Teacher supports • Engaging environments • Effective curricula • Language development • Teacher/Child interactions • Awareness Activities • Program structure
	Interview with diabetes nutrition specialist	<ul style="list-style-type: none"> • Nutrition Specialist 	<ul style="list-style-type: none"> • Improvement • Research 	<ul style="list-style-type: none"> • Health Awareness • Nutritional awareness • Safety awareness • Awareness Activities
	Interview with curriculum design expert	<ul style="list-style-type: none"> • Curriculum designer in ADEC 	<ul style="list-style-type: none"> • Improvement • Research 	<ul style="list-style-type: none"> • Curriculum methods • Engaging environments • Effective curricula • Program structure • Administration-Teacher communication • Child development curriculum
Evaluating the Prototype	Educational software observation	<ul style="list-style-type: none"> • Potential users – preschooler age (3-5 years) 	<ul style="list-style-type: none"> • Improvement • Evaluation • Monitoring 	<ul style="list-style-type: none"> • Interacting • Health awareness • Nutritional awareness • Safety awareness • Language interaction • Teacher/Child interactions • Behavior • Acceptance of child • Variety of skills used. • Learning outcomes • Social development • Emotional development • Physical development • Intellectual development
	Educational software evaluation	<ul style="list-style-type: none"> • Teachers • Users • Parents/Guardian 	<ul style="list-style-type: none"> • Improvement • Evaluation 	<ul style="list-style-type: none"> • Parent involvement • Staff involvement. • Teacher supports • Learning outcomes • Teacher-parent communication • Computer effectiveness. • Computer efficiency • Educational value.

TABLE (4.2): LEARNING THEORIES:

Theory	Writer	Description	Application
<i>Intrinsic Motivation</i>	<i>Malone & Lepper (1987)</i>	Malone and Lepper provided the theoretical foundations of GAME-BASED LEARNING where they found that games are fun and they offer a wonderful learning opportunity.	The Music that will be played along the game will reflect the mood of the game success or fail.
			The player is in control of the game can go to the next step or go back to re-correct a previous answer.
<i>Cognitive Apprenticeship</i>	<i>Brown et. al. (1989)</i>	Scaffolding or having an expert teach/help you learn new material is an effective learning strategy.	The pictures are a scaffolding mechanism to help players learn more about the healthy habits.
			Feedback - The game that provide an immediate feedback to a player's action is an effective learning tool that give the players a chance to correct his/her mistake. (Rieber, 1996; Hogle, 1996; Lieberman, 1998)
<i>Experiential Learning</i>	<i>Dewey (1938)</i>	" <i>Learning by doing</i> " is one of the best forms of learning.	One of the benefits of the game is to provide students a way to practice their knowledge over and over and correct them self.

TABLE (4.3): DESIGNING THEORIES:

Theory	Writer	Description	Application
<i>Media Equation</i>	<i>Reeves & Nass (1996)</i>	Nass and Reeves' key finding was to make the computer more social or human.	"Instant messaging" was used to interact with the users and encourage them to continue or to think if they made wrong answer.
	<i>Dempsey, et. al. (1994),(1996)</i>	The design of the games interface must be spontaneous. Dempsey's study finds that more than 79% of the players favored "trial and error" as the method to learn how to play a game.	Simple interface which is easy for preschooler age. Instructions provided in the beginning of each game play.
<i>Guerilla HCI</i>	<i>Nielsen (1990)</i>	Observe three users and a designer will see major flaws in his/her design. This tactic was frequently used for the different iterations of game.	User tested 9 preschool students (3 of 3yrs, 3 of 4yrs, and 3 of 5 yrs). User tested 3 experts (KG teacher, Nutrition specialist, curriculum designer) User tested parents of the potential users.