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The Virtual Museum "*VM*" as a Tool of Science and Technology Literacy in Informal Environment

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Dedication

I dedicate this research to the memory of my father
“May Allah mercy him”

Declaration

I certify that this thesis submitted for the degree of Master is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not been submitted for higher degree to any other university or institution.

Signature:

Bushra Izzat Al-Badawi

Date:

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Abstract

This study aims to develop Virtual Museum "VM" as a tool of science and technology literacy for informal learning, from the perspective of the participants through the stages of planning, creating, and evaluating a user-centered Virtual Museum that would support lower basic grade; allows students to interact and navigate within a virtual interface in Arabic language.

This study investigated experts (Pedagogical, Subject matter, and Multimedia), parents, and student's views on the *VM* as a science and technology literacy tool in informal learning. The research design followed the educational Research and Development (R& D) methodology which includes the following steps: Research and information collecting "Proof of concept"; Product planning and design; Develop preliminary form of product; Preliminary field testing; Main product revision; Main field testing, and Final product revision.

The researcher developed instruments of evaluation: preliminary evaluation (experts' form, user evaluation (parent', and children' forms). A focus group interview was conducted to draw children's perceptions towards the use of the *VM*. A prototype of the virtual museum was developed and then evaluated by experts in the preliminary field test; revisions were made to the *VM* based on their feedback. User evaluation was held in the second semester of 2010\2011; final revision was made upon their notes

The major findings were; the preliminary field test yielded positive feedback from experts toward the *VM*. The various experts have similar opinions toward the *VM*. The open results from preliminary field test suggested that the *VM* could be used as an informal learning by links to other museums and educational resources. However, further consideration should be paid to the design to address matter of science, technology and society (STS); Increasing the application to higher level of thinking, the need to develop the child's ability to creative thinking and production of new knowledge, and more social interaction. The parents' and children' feedback toward the *VM*'s was positive.

Children were looking forward to designing virtual museums for other subjects. Students' comments showed a greater interest level in learning science with technology through games and multimedia; suggesting that virtual science museums can be educationally valuable and supportive, also an alternative to traditional teaching methods. The children were very excited with the use of the *VM*, it helped them understand the subject content and navigate to search scientific information.

The researcher recommended to expand the VM idea to other subjects, and to establish a permanent committee that consists of pedagogical, subject matter experts, and multimedia experts. The researcher also recommended to study virtual museums effects on students motivation, learning styles, and attitudes towards science and technology, create virtual museums included the Virtual Reality.

الملخص

هدفت هذه الدراسة لتطوير متحف افتراضي كأداة للعلوم والتكنولوجيا في بيئة غير رسمية لطلاب المرحلة الاساسيه الدنيا؛ من وجهة نظر المشاركين: التربويين ، وخبراء المادة، وخبراء الوسائط المتعددة، والآباء ، والطلبة. وذلك خلال مراحل التخطيط ، والتطوير، والتقييم. اتبعت الباحثة منهجية البحث والتطوير (R&D). وفق الخطوات التالية: البحث وجمع المعلومات. "تحديد المفاهيم"، وتخطيط وتصميم المنتج، و تطوير النموذج الأولي للمنتج، والاختبار الميداني الأولي من قبل الخبراء، و تنقيح المنتج، والاختبار الميداني الرئيسي من قبل المستخدمين (الاباء، والاطفال). ومن ثم مراجعة المنتج النهائي. قامت الباحثة بتطوير أدوات تقييم (للخبراء، والآباء ، والأطفال) وترجمتها للعربية معتمدة ثبات الترجمة بحساب درجة الاتفاق بين مترجمين. تم انتاج النموذج الأولي من المتحف الافتراضي وتقييمه من قبل الخبراء. أجريت التعديلات اللازمة، ثم تم تقييمة من قبل الآباء والطلاب في الفصل الثاني من العام الدراسي 2011/2010، كما وأجرت الباحثة مقابلة مركزه مع الطلاب للتعمق في ارائهم نحو المتحف الافتراضي. ثم قامت الباحثة بمراجعة المتحف بناء على نتائج تقييم المستخدمين. وكانت أهم النتائج أن ابدى مختلف الخبراء وجهات نظر مماثلة وكانت ردود فعل ايجابية نحو المتحف. أشار الخبراء من الممكن أن يكون المتحف الافتراضي بيئة تعلم غير رسمية؛ ومن المتوقع أن يؤثر على تدريس العلوم والتكنولوجيا. كما أشارت النتائج الى ضرورة الاهتمام اكثر بالتصميم ليعكس معايير العلم والتكنولوجيا والمجتمع، والتركيز على دمج التفكير الابداعي وإنتاج معرفة جديدة. أما أراء الأباء والأطفال فكانت ايجابية نحو المتحف. وأفادت ملاحظات الطلاب أنهم على مستوى قدر أكبر من الاهتمام في تعلم العلوم والتكنولوجيا من خلال الألعاب والوسائط المتعددة مما يوحي بأن المتاحف العلمية الافتراضية يمكن أن تكون ذات قيمة تربويا، داعمة لطرق التدريس التقليدية إذا اخذ بعين الاعتبار التصميم المناسب للمستخدم. وأكد الأطفال على ضرورة انتاج متاحف افتراضية للمواد والمواضيع الأخرى. وأكدت نتائج مقابلة الأطفال التي كانوا في غاية السعادة باستخدام المتحف أنه ساعدهم على فهم محتوى الموضوع، والبحث عن المعلومات العلمية.

من أهم التوصيات التي انبثقت عن النتائج؛ توسيع فكرة المتحف ليتضمن مواد ومواضيع أخرى بالشراكة مع فريق من التربويين وخبراء المادة وخبراء الوسائط المتعددة. دراسة كيفية تأثير المتحف الافتراضي على الدافعية وانماط التعليم والاتجاهات نحو العلوم والتكنولوجيا. تطوير متحف افتراضي يشمل تطبيقات الواقع الافتراضي Virtual Reality.

CHAPTER ONE

This chapter contains the following components: Introduction; Background; Rationale; Statement of the Problem; Purpose of the Study; Research Questions; Nature of the Study; Significance of the Study; Definition of Terms; Limitations; Organizing the Remainder of the Study.

1.1 Introduction

Thinking about how children learn has been entirely affected by technology, in particular by computers, the internet and the web based resources. The technological tools and media that are now available are raising questions about the relative status of formal and informal learning. Learning can now be more mobile; can happen anytime, anywhere, expanding the view of when and where learning happens; closing the space between learning in and out-of-school (Wishart and Triggs, 2010).

People who are living in today's world are encountering a new scientific and technological advancements everyday. People who live in a society, in which scientific and technological innovation and advances occur, should communicate with others effectively; evaluate events occurring around them critically, should follow up scientific developments and evaluate possible results of these developments. At the same time we live in a world that is increasingly dependent on technology (Dugger, 2001). People who are careless about technology could hardly succeed in today life.

Relation between science and technology is continuous and endless. Science generates knowledge for its own sake, proposing and testing explanations. Technology, on the other hand, develops human-made solutions to real-world problems. Of course, science uses technology to generate knowledge and technology uses scientific knowledge to generate solutions, so the two are integrally connected; but they are different fields driven by different concepts and processes (Bybee, 2000). Scientific education should prepare children for an increasingly scientific and technological world where citizens will need to learn and apply knowledge to solve real-world problems. Unfortunately, our children are not learning the nature of science or developing deep conceptual understandings of scientific concepts, nor do they find science interesting.

The International Technology Education Association (ITEA) defined relationship between science and technology as follows;

> Science is a study of the natural world and technology extends people's abilities to modify that world. Science and technology are different, yet symbiotic. Technology is much more than applied science and science is quite different from applied technology. When people use technology to alter the natural world, they make an impact on science. Science is dependent upon technology to develop, test, experiment, verify, and apply many of its natural laws, theories, and principles. Likewise, technology is dependent upon science for its understanding of how the natural world is structured and how it functions (ITEA, 2000).

As already stated there is an emotional connection between science and technology. Scientists generate new information, through it, technology can be produced. Scientists use new tools or technology for the purpose of science and they generate newer information. This process is up to infinity and newer scientific knowledge that facilitates process of technology generating and newer technology that enables scientists to produce newer information.

The World Conference on Education for All (1990) declared that "... every person . . . shall be able to benefit from educational opportunities designed to meet basic learning needs. These needs comprise both essential tools (such as literacy) and the basic learning content (knowledge, skills, values, and attitudes) required by human beings to be able to participate fully to improve the quality of their lives, to make informed decisions and to continue learning." today's education needs to prepare people to bright future. This requires an increasing degree of scientific and technological literacy on the society.

1.2 Background

The need for a technologically expert manpower is growing with the use of digitized computers, cell phones, and e-mail to conduct all over the world. As the influence of science and technology in our daily lives grows, the importance of interdisciplinary both science and technology and how technology influences science and scientists thinking should be considered. The Benchmarks for Science Literacy, developed under Project 2061 to identify how students should progress in understanding science, seeks to develop critical thinking skills, understanding the application of science and technology, and general knowledge through public education methods (formal schooling, and informal facilities) as declared in American Association for the Advancement of Science (AAAS, 1993). Scientific topics covered by the Benchmarks include the nature of science and our surroundings in the universe. To achieve the goals set by the Benchmarks, formal and informal education facilities need to work together to provide the student, at any level of education, a more robust picture of the nature of science (Hofstein *et al.,* 1997).

The terms formal and informal learning have been used to differentiate between obligatory and voluntary learning (Figure 1.1).

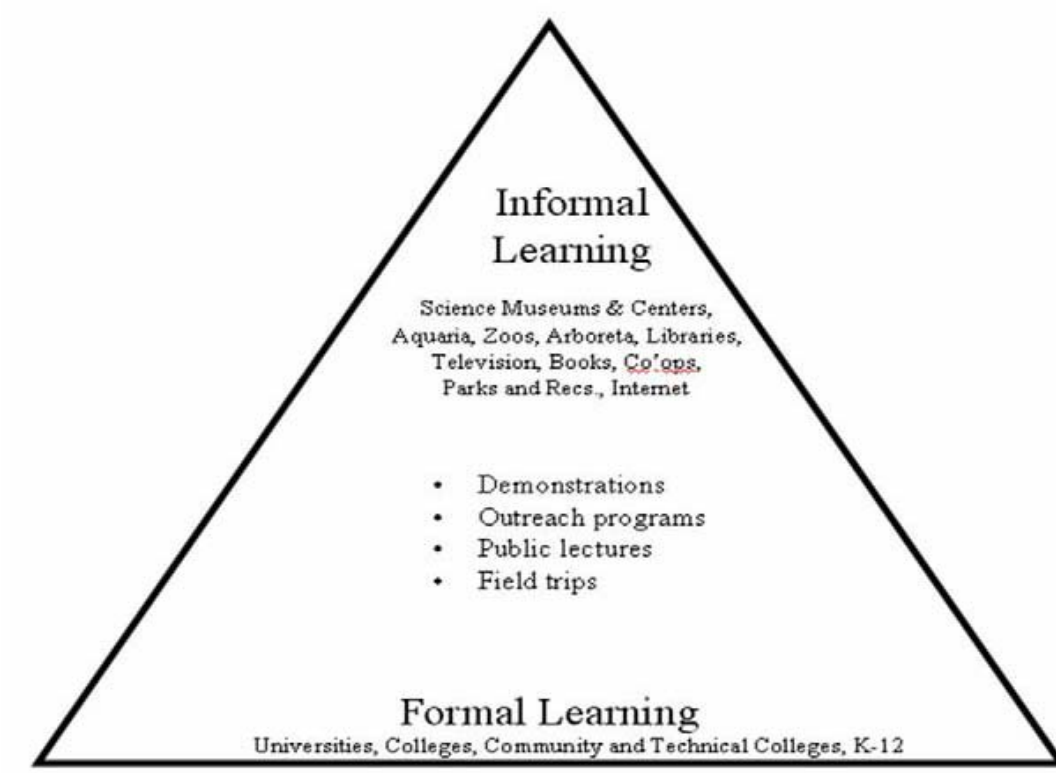

Figure 1.1: Overlap of Formal and Informal Education

(French, 2007, p.4)

Formal learning includes universities, colleges, community and technical colleges, K-12. Informal learning includes museums, science centers, community organizations, aquaria, zoos, botanical gardens, as well as television and print media. Traditional views of the learning environments set formal and informal learning education services; though both use similar teaching methods, both have their own strengths and weaknesses. Formal education allows students to learn content in depth; teachers telling and students listening. Informal learning experiences offer students of all ages the opportunity to participate in programs not typically available in the formal learning context and for facilitators to show the interest they have for the science they love (French, 2007). Distinguish to formal education, informal education offers more freedom of choice to learn about material presented.

The role of technology in education has continued to increase and evolve in much the same way it has in the museum discipline. Educators have been exploring information technologies for the purpose of improving teaching practice in a number of ways. By the advent of the microcomputer in the late 1970s, a number of teaching approaches had been developed that make use of the computer as a tutor tool (Taylor, 1980). Educational computing practice continued to evolve as the capabilities of and access to technology improved. In the late 1980s, teachers began exploring the uses of multimedia in classroom practice, a strategy that was stimulated further by the advent of the WWW and graphical Web browsers (Office of Technology Assessment, 1995). By the mid- 1990s the term "virtual museum" was being applied to web-based student learning projects (McKenzie, 1996). As a teaching strategy, virtual museum projects implement several aspects of school reform, such as student-centered

learning, collaborative learning, authentic learning, multidisciplinary thematic instruction, and integrated computer literacy instruction. (McKenzie, 1997).

A virtual museum "is a collection of digital electronic artifacts and information resources including paintings, drawings, photographs, diagrams, graphs, recordings, video segments, newspaper articles, transcripts of interviews, numerical databases, and a host of other items that may be stored on the virtual museum's file server" (McKenzie, 1997).

VM is a learning resource package that enables students to discover the wonders of science that may be from their home. This virtual program presents science in a way that is accessible and interactive, combining hands-on activities with online discovery. Focus on science, technology, history; in informal environmental studies that will enable contextualize learning.

1.3 Rationale

The researcher sees to contribute her practical experience in computer science and the requirements of master degree in method of teaching. So she created *VM* as a tool of science and technology literacy that could expand the opportunities for children to learn in informal education, as declared in the American Association for the Advancement of Science (AAAS, 1989) informal education experiences can have a significant impact on children and their learning. It is becoming evident that schools should pick the most important concepts and skills to emphasize so that they can concentrate on the quality of understanding rather than the quantity of information presented. Therefore, informal education experiences are rich and deep in content, and can be a very valuable compliment to formal education.

Just like discovering a new place, children discover computer and this aspect of their development makes it extensively easier for them to be taught with. Furthermore, it has been observed that students are more paying attention and task oriented when working with computers (Snyder, 1994). For successful integration Buckingham (1993) believes that information technology education must find away of developing the relationship between what is taught in schools, and the technology that children are covered to in the home. With internet boom, many households have access to the web and the relationship Buckingham refers to is a reality.

The research presented deals with integrating technology into the learning experience of lower basic grades, integration is defined as utilizing a computer in some of the hands on activities children participate in during a visit to the VM, and they could be able work with their parents, matured brothers.

The lower basic grades in Palestine didn't take technology as a separate subject, the individuals should guide from the first grades to be scientifically and technologically literate. Cause the weakness of science education in Palestinian education and the importance of improving it for Palestinian society and for its present children and future adults, it should be identified and agreed upon between the cooperating organizations.

Individuals should recognize the technological environment they live in as well as the dimensions and facilities of technology, and should be aware of the fact that they could make

use of these opportunities through enabling an individual, who is in a technological media, to attain the required knowledge, skills, and attitudes. In the light of this aim, this study involves the using of Virtual Museum "VM" to lower basic grades in relation with science and technology in an informal environment.

Holbrook *et al* (2000) announced that one approach, which can guide science education towards greater relevance for the 21st century, is the use of STL supplementary teaching materials. These materials are not extensions of the textbook, but are additional resources for the teacher. They are intended to be optional and to be used as and when the teacher feels they would be appropriate. If the materials allow students to engage in activities relevant to STL, they enhance the learning situation and hence guide students to achieve the intended educational objectives.

1.4 Statement of the Problem

In order to create scientific and technology literacy and provide intellectual enrichment virtual museum, to bridge the gab between science and technology in informal environment. From the view of the Faculty of Education that the museum of science in the university served the upper grades, the need to be more closely to lower basic grades, the same as the recommendation of the teacher in Model School Networking (MSN) training, to create activities more suitable for lower basic grades. As the recommendation of the pilot study the necessity to integrate technology in teaching science, and to computerize some concept in science for lower basic grades in informal teaching to emphasize formal teaching.

So the needs to establish virtual museum which serve the lower basic grades often have difficulties in focusing attention on learning and easily lose their interest. The researcher sees that the integrating technology into the program that children receive generates interest, reinforces materials covered and emphasizes the importance of the child's curiosity. Technology lessons would provide valuable life learning opportunities for children and teachers alike. To explore how the Virtual Museum, could engage lower Basic grades in learning some scientific concept such as Solar System, plants, light, water, the importance of interdisciplinary both science and technology and how technology influence science and society.

How could the VM be a tool of science and technology literacy in informal teaching from the perspective of the participants (experts, parents, and children)?

1.5 Purpose of the study

The objectives of this research project were:
To develop Virtual Museum through the stages of planning, creating, and evaluating a user-centered Virtual Museum that would support lower basic grades; allows students the ability to interact and navigate within a virtual interface in Arabic language.
To develop virtual museum from the perspective of the participants to enable the researcher to explore, discover, and benefit the participant's experiences through an active role into the study and data collecting process.

To develop a virtual museum as a tool of science and technology literacy in informal environment for lower Basic grades.

1.6 Research questions

In order to create a user-centered Virtual Museum:
I. Could the three experts (Pedagogical, Subject matter, and Multimedia) cooperate effectively to create a virtual museum which promotes science and technology in learning?
This question was answered through the following sub-questions:

1. What are the opinions of the experts about the *VM*?
2. Is there any significant difference in experts opinions related to expert type (Pedagogical, Subject matter, and Multimedia)?
3. Is there any significant difference in experts opinions related to academic qualifications (B.A., MA. and Ph.D.)?
4. Is there any significant difference in experts' opinions related to experience level (less than four years, from four to seven years, more than seven years)?
5. Is there any significant difference in experts' opinions related to professional roles (school teacher, university teacher)?
6. What are the possible deficiencies or strengths of the *VM*?
7. What is the overall quality of these instructional materials?
8. Could the *VM* as informal tool play roll in science and technology literacy of lower basic grades?

II. Could the parents cooperate effectively to create a virtual museum which promotes science and technology in learning? This question was answered through the following sub-questions:

1. What are the opinions of parents about the *VM*?
2. Is there any significant difference in parents opinions related to academic qualifications (diploma, B.A, and upper than B.A)?
3. Is there any significant difference in parents opinions related to their child grade (first, second, third, and fourth)?
4. Is there any significant difference in parents opinions related to child achievement (weak, good, very good, and excellent)

III. Could the children cooperate effectively to create a virtual museum which promotes science and technology in learning? This question was answered through the following sub-questions:

1. What are the opinions of children about the *VM*?
2. Is there any significant difference in children opinions related to child grade (first, second, third, and fourth)?
3. Is there any significant difference in children opinions related to child achievement (weak, good, very good, and excellent)?

1.7 Nature of the study

This study has followed Borg and Gall's (1983; Borg (1987), Gall *et al.*, 2003) Research and Development (R & D) methodology for developing educational *VM*.

The researcher has selected a group of science educators, subject matter experts and the multimedia experts to portray the importance of feedback from all of them through the planning and development stages in order to create better designed for virtual museum exhibits.

Another group of students from lower basic grades, and parents have been selected to participate in this study, facilities need to work together to provide a more robust picture of science and technology literacy through using the *VM*. To portray how the learners provided reflective feedback helpfully better-designed the *VM*.

1.8 Significant of the study

This study is significant because it is mutually beneficial to pedagogical, multimedia designer and subject matter experts as well as to lower basic school students. The study is of academic benefit may be shared in science and technology literacy in informal education.

•The finding of the study may help the Students supporting their learning and performances in an informal manner.
•Teacher, who has been looking for any type of support for their students' learning and performances, should find *VM* useful.
• Using the *VM* in the context of school could be support shifting the paradigm of instruction from teacher-centered to student-centered.
• One of the outcomes of this study will be the construction of a body of design principles that can guide future development of similar projects in other concepts and other subject area.
•This study can form the foundation for future research in this area.

1.9 Definitions

Frequently used terms were summarized below. From the review of literature and previous studies, a unified understanding of these terms and their definitions will allow the reader to more easily interpret the study and its findings.

Science Literacy (SL): Two accepted definitions are made by Benchmarks of Science Literacy the National Research Council (NRC, 1996)

Benchmarks of Science Literacy definition is: A literate person is an educated person, one having certain knowledge or competencies. In today's world, adult literacy has come to include knowledge and competencies associated with science, mathematics, and technology. People who are literate in science are not necessarily able to do science, mathematics or engineering in a professional sense, any more than a music-literate person needs to be able to compose music or play an instrument.

National Science Education Standards (NSES) definition is: Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity. Scientific literacy means that a person can ask, find, or determine

answers to questions derived from curiosity and about everyday experiences. It means that a person has the ability to describe, explain and predict natural phenomena.

Technology Literacy (TL): a complex set of socially and culturally situated values, practices, and skills. Technological literacy refers to social and cultural contexts for discourse and communication, as well as the social and linguistic products and practices of communication and the ways in which electronic communication environments have become essential parts of our cultural understanding of what it means to be literate (Selfe,1999).

Formal education: The traditional way that takes place in teaching science for elementary class one teacher tell, many student listening.

Informal education: Is education that takes place out side the classroom limitation, environment without boundary (Messenger, 2000).

Virtual Museum (VM): A virtual museum is a collection of digital electronic artifacts and information resources. The collection may include paintings, drawings, photographs, diagrams, graphs, recordings, video segments, newspaper articles, transcripts of interviews, numerical databases, and a host of other items which may be stored on the virtual museum's file server (McKenzie, 1997).

The Virtual Science Museum: is a database that incorporates science concepts (plants, water, light, solar system, classification) includes audio, video, text, multimedia gaming, and colorful photographs, all of which provide an understanding virtual situation. Future view it could be based upon principal resources for student, parents, and teacher

Virtual Reality: is not just a tool; it is at once technology, medium, and engine of social relations. It not only structures social relations, it is the space within which the relations occur and the tool that individuals use to enter that space. It is more than the context within which social relations occur, for it is commented on and imaginatively constructed by symbolic processes initiated and maintained by individuals and groups (Mayer, 1999).

1.10 Limitations

This study could be limited to the small sample and its specific nature. This limitation was compounded due to the varying nature of each particular of the *VM* and small purposeful size of the research participants. The students sample for the study has collected during a season and day which is convenient for the study. The sample regarded as limiting due to the backgrounds of science educators, and achievement considerations to the students.

The environmental and instruments aspects of the *VM* underdeveloped and therefore pose a weakness to the study. The emphasis within the *VM* lies on the learner's responsibility while recognizing environmental conditions and constraints. The selected samples with short period of time may not yield the ideal conditions for learning in the *VM* states will occur when balance is achieved between the informal and formal education.

The validity of the study depended on the self-selection of participants, as well as selection and qualification of the panelists (Stitt-Gohdes and Cr`ews, 2004). Researcher bias may also be a limiting factor that could have influenced this study.

1.11 Organizing the remainder of the study

The literature review and the previous studies relating to the significant elements of this study are presented in chapter two, followed by chapter three describing the research methodology that is applied to gather data and explore the research questions for this study. Chapter four contains preliminary field test results and discussion. Chapter five contains user evaluation results and discussion. Chapter six summarizes the results, recommendations, and implications for future research.

CHAPTER TWO

Review of the literature and previous studies

This chapter contains two sections:

The first section reviews the significance of the literature and is divided into four parts. The first part of the chapter examines virtual museum concepts, types, characteristics, and the reason to develop. The second component of the chapter looks at the evaluation and effectiveness of the development of virtual museum exhibits through effective design and usability of the software and website. The third part includes formal and informal education. Lastly science, technology literacy, and society have been able to move across geographical boundaries and allow students to make meaningful, contextual connections individually within group or at home that might not otherwise have been possible.

The second section contains the previous studies; divided into four parts. The first part reviews previous studies related to *VM*. The second part of the chapter reviews previous studies related to effective design and usability of the software. The third part of the chapter reviews studies related to informal environments. The fourth component of the chapter looks at the previous studies related to science, technology and society literacy.

2.1 Section one literature review

This section presents the literature reviews; it is divided into four parts. The first part reviews literature related to *VM*. The second part of the chapter reviews literature related to effective design and usability of the software. The third part of the chapter literature related to informal environments. The fourth component of the chapter looks at the literature related to science, technology and society literacy.

2.1.1 Part one. Virtual museum concepts, types, characteristics, and the reason to develop

2.1.1.1. Virtual museum concepts:

First of all, computer programs were designed to store systematically information about museum collections that enabled museums to distribute images of their collections. With the improvement of the multimedia capabilities of computers, museums could add graphical displays of their collections to their records. When the first graphical Web browsers emerged in 1993, several museums posted publicly accessible virtual exhibitions from their collections. Virtual museums expand the outreach of museums to their public, giving people who cannot voluntarily visit the museum facilities access to museum collections. Virtual museums have become a new strategy museums use to fulfill their mission as educational institutions that promote the heritage of the communities they serve. Educational computing practice continued to evolve as the capabilities of and access to technology improved. In the late 1980s, teachers began exploring the uses of multimedia in classroom practice, a strategy that was stimulated further by the advent of the WWW and graphical Web browsers (Office of Technology

Assessment, 1995). By the mid- 1990s the term "virtual museum" was being applied to web-based student learning projects (McKenzie, 1996). Student-developed virtual museums can be fairly involved, collaborative learning projects in which students' research, record, design and implement a multimedia presentation that simulates the kind of experience a museum visit might offer. As a teaching strategy, virtual museum projects implement several aspects of school reform, such as student-centered learning, collaborative learning, authentic learning, multidisciplinary thematic instruction, and integrated computer literacy instruction (McKenzie, 1997).

The virtual museum environment moves from a teacher-centered environment to a learner-centered one where students construct new information based upon their previous knowledge. Students in a virtual world are able to work independently of one another. Students create, build, and negotiate multiple media when constructing knowledge in Web-based learning (Gallini, 2001). For this move, museum must change from a collection museum to user center museum that meeting point on the visitors.

Davis as mentioned in Schweibenz (1998) fiend that: "The digital museum can be visitor-centered rather than curator-centered." An important step towards the "audience-driven" or "visitor-centered" museum is that museums try to reach out to their prospective visitors.

The definitions' of the "Virtual Museum" remains under practical construction, and in the museum and information communities a variety of terms are used synonymously for collections of digitized objects and/or exhibits, such as electronic museum, digital museum, on-line museum, hypermedia museum, and meta-museum, among others. Similarly, there have been variations on what actually constitutes a virtual museum or the extent of the virtually that is necessary for a museum to be termed virtual; for example, on-line counterparts of real museums, versus those exclusively accessible via the Internet" (Dietz *et al.*, 2005).

> Hoptman as mentioned in Dietze *et al.* (2005) said that "the concept of the Virtual Museum demonstrates how limitations imposed by the traditional method of organizing and presenting information can be overcome in the context of museum visits. In a nutshell, the Virtual Museum provides multiple levels, perspectives, and dimensions of information about a particular topic: it provides not only multimedia (print, visual images through photographs, illustrations or video, and audio), but, more important, it provides information that has not been filtered out through these traditional methods".

Wikipedia, the free encyclopedia defined "the virtual museum that exists only online. A virtual museum is also known as an online museum, electronic museum, hyper museum, digital museum, cyber museum or Web museum" (Wikipedia online).

In the online version of the Encyclopedia Britannica (2011) , the "Virtual Museum" described as collection of digitally recorded images, sound files, text documents, and other data of historical, scientific, or cultural interest that are accessed through electronic media. A virtual museum does not house actual objects and therefore lacks the permanence and unique qualities of a museum in the institutional definition of the term.

"This "virtual museum" opens itself to an interactive dialog with visitors offering those connected digital objects and information that is readily accessible from outside the museum.

At its best, the "virtual museum" connects the visitors with valuable information across the entire globe and gives them a dynamic, multidisciplinary and multimedia approach to the collection as McKenzie puts it (schwebenz, 1998).

Also McKenzie (1997) defined a virtual museum as follows:

> "Virtual museums live on the World Wide Web . . . the Internet. The door to the virtually museum is electronic. You drive up for a visit on the Information Highway, but you need no car. A computer and an Internet account serve as your entrance ticket and transportation combined. A virtual museum is an organized collection of electronic artifacts and information resources—virtually anything which can be digitized. The collections may include paintings, drawings, photographs, diagrams, graphs, recordings, video segments, newspaper articles, and transcripts of interviews, numerical databases and a host of other items which may be saved on the virtual museum's file server. It may also offer pointers to great resources around the world relevant to the museum's main focus".

The definitions varies from one to other depends upon the backgrounds of the researchers working in this field. "physical and virtual against the virtual only; the virtual of physical and the virtual of born digital" (Ditze *et al*, 2005). The VM in this research doesn't exist physically. It is virtual science concepts collected in database for lower basic grades include virtual rooms with electronic doors (computer experiments, home experiments, worksheet, history of science, technology of science, games, films, links) where visitors can virtually explore real curriculum.

2.1.1.2. Types of virtual museum:

McKenzie distinguished between two types of virtual museums:

The first one learning museums that offer generous online learning resources to attain learning, enjoyment, and research. This museum is accountable to reflect the physical museum, but it may also be a virtual exhibit in itself, that is not dependent upon the physical museum. A virtual website is constructed like a museum, containing a clear museum program that offers a center of information for visits to the museum and for on-line learning. These museums enable repeat visits to the collections of the virtual museum and play a significant role in the development of learning by means of study methods and discovery. In addition, this is a way of bringing the concept of museums to the supportive community in an educational and continuous process.

Learning museums promote active, student-centered learning along with real world problem-solving**,** put students in roles which prepare them for the workplace; Learning museums are Dynamic, Multidisciplinary, and Multisensory. Museums are also fine vehicles for multidisciplinary studies, as the collection may include everything from music and art to science and politics and mathematics. Virtual museums offer multi-sensory opportunities appealing to a variety of learning styles and multiple intelligences. Virtual museums have great advantages over textbooks - bringing vitality, color and motion to student exploration. Offers to the visitor additional sources of information associated with the topic (links) it can involve learning that crosses the lines between disciplines including art, music, mathematics, science, social studies and writing. They are multi sensory, giving students the opportunity to

create knowledge in many modal forms and offering visual, aural, spatial, and textual modes of learning to museum visitors.

The second one marketing museums that serve to advertise the offerings a physical museum has, giving schedules of events, opening hours, entrance fees, and in some cases, museum shop sales, the majority of this type of virtual museum includes a small number of "stimulating" items, the opening hours, the ticket prices, and frequently, the possibility of purchasing tickets through the virtual site, the exhibitions displayed in the museum, the location of the museum and directions how to get there, a map of the museum, etc. (McKenzie, 1997).

The Virtual museums in this research offer an opportunity for children to work on a database that involved computerized experiments, films, worksheet, and various links suitable to multi learning styles. A database of such local virtual museums might provide children and parents with rich and excited materials.

2.1.1.3. Virtual museum characteristics:

When looking at museum content, according to McKenzie (1997), a quality virtual learning experience would need to incorporate the following characteristics:

- The online collection is substantial.
- The content offerings are rich.
- The "lobby" or entrance is both inviting and user-friendly.
- It would take dozens of visits to explore the contents.
- The museum offers many different kinds of learning activities suited to different age levels and learning styles.
- The virtual visit increases desire for a "real time" visit to the original museum building.

Lepouras *et al (*2004) declared that the development of the virtual museum system to be installed locally at participating museums comprised of four major phases:
– Requirements analysis and specifications,
– Design,
– Prototyping and evaluation,
– Full-scale implementation.

The researcher created a virtual museum with analysis the needs offer rich content, user friendly entrance with different learning styles, with experts and user evaluation.

2.1.1.4. The benefits to develop virtual museum:

Creating a virtual museum may provide superior, vivid and enjoyable presentation of certain exhibits to visitors. There are also several other reasons that may hold the effort of developing such a system:

- Lack of space: Since exhibition space in the majority of museums is usually limited, most museums display a fraction of the exhibits they own. Furthermore, some objects

may be too delicate or valuable to be exhibited. Stored objects can be effectively displayed by means of a virtual reality presentation within the spatial context of the real museum.

- Simulation of environment: a virtual environment system offers visitors the possibility to view a simulation of important objects, buildings or environments; these environments may either: No longer exist today. Be somehow damaged and in need of reconstruction or not be easily experienced, either because they exist at a remote site or because their condition does not allow for their interior to be navigated.
- Presentation of an unsafe or remote environment: A virtual environment system is also a safe way of visiting an environment, which may be too difficult or too dangerous to physically visit (e.g., navigation within a volcano or on the mountains of Mars).
- Mobile exhibition: the digitized content of a museum may be experienced in a realistic manner via a mobile virtual environment system, which can be easily transported to any exhibition site or remote location. This fact may afford a wider audience to view important exhibitions without the necessity of traveling far. The design and development of a successful and compelling virtual museum system is a rather difficult and complex task which involves addressing cultural, ergonomic, and technological issues, as well as a series of other issues (Lepouras *et al.*, 2004)

2.1.2 Part two. The evaluation and effectiveness of the development of virtual museum

2.1.2.1. Usability:

Usability Basics In general, usability refers to how fit users can learn and use a product to achieve specific goals and how satisfied with the process. (Nielsen, 1993).

2.1.2.2. Usability objectives:

To produce products those have a high degree of usability. Rubin (1984) describes usability objectives as:

- Usefulness - product enables user to achieve their goals - the tasks that it was designed to carry out and/or wants needs of user.
- Effectiveness (ease of use) - quantitatively measured by speed of performance or error rate and is tied to a percentage of users.
- Learnability - user's ability to operate the system to some defined level of competence after some predetermined period of training. Also, refers to ability for infrequent users to relearn the system.
- Attitude (likeability) - user's perceptions, feelings and opinions of the product, usually captured through both written and oral communication.

Rubin detected the User-Centered Design Process as follows:

- The users are in the center of a double circle.
- The inner ring contains: Context; Objectives; Environment and Goals.
- The outer ring contains: Task Detail; Task Content; Task Organization and Task Flow.

As describe in Fig 2.1:

Fig 2.1 User Center Design (Rubin, 1984)

2.1.2.3. What Does Usability Measure?

"Usability measures the quality of a users' experience when interacting with a product or system-whether a Web site, a software application, mobile technology, or any user-operated device.

It is important to realize that usability is not a single, one-dimensional property of a user interface. Usability is a combination of factors including:

- Ease of learning: How fast can a user who has never seen the user interface before learn it sufficiently well to accomplish basic tasks?
- Efficiency of use: Once an experienced user has learned to use the system, how fast can he or she accomplish tasks?
- Memorability: If a user has used the system before, can he or she remember enough to use it effectively the next time or does the user have to start over again learning everything?
- Error frequency and severity: How often do users make errors while using the system, how serious are these errors, and how do users recover from these errors?

- Subjective satisfaction: How much does the user like using the system?" (Usability basics, usability.gov)

While assessing particular outcomes, we must look not only at how technology is being utilized within the classroom and how the instructional technologies are designed, but also we must evaluate the design of the technology itself. This is especially critical with online exhibit experiences. As user input is collected and analyzed, it is fed back into the design process, resulting in progressive refinement and improvement of the system under design (Vergo *et al.*, 2001). Nielsen (1993) emphasizes that usability principles should apply to Web design and incorporate user evaluations into the design process first through a heuristic evaluation, followed by usability testing with a redesign of the product after each phase of evaluation.

Finding out what visitors are actually seeing and doing at the exhibit is relatively easy and can be accomplished by direct observation perhaps supplemented by interviews. If this is done as an integral part of the exhibit-development process, it can ensure that an exhibit will succeed in engaging visitors as the developers intend (Ansbacher, 1998, p. 8).

In this research, the researcher refined the VM through the feedback from the experts and users with developed instruments through the development and planning stages in order to create new and better designed museum exhibits.

2.1.2.4. Systematic Usability Evaluation (SUE):

A technique for evaluating the usability of hypermedia applications; either off-line (i.e., multimedia CD-ROMs or Information Points) or on-line (i.e., Websites) named SUE -. Four attributes can be used to characterize: heuristic, empirical, systematic, and model-based. Heuristic evaluation falls into the broader range of usability engineering methods, which do not involve end users, but only "expert" evaluators. SUE is also empirical, in the sense that user testing is used to validate and refine the result of the expert. The combination of expert and empirical testing ensures the most accurate evaluation results, coupled with cost-effectiveness. SUE is systematic in the way usability experts and empirical testing is performed. The expert is carried on by executing a set of predefined evaluation activities, called abstract tasks. The use of abstract tasks makes the heuristic evaluation better organized and more effective, and also encourages standardization across different evaluators and evaluation processes. The empirical testing is carried on by requiring some end-users to perform concrete tasks, i.e. specific activities, based upon the result of inspection. The use of concrete tasks makes the empirical testing more organized and cost-effective. SUE, finally, is *model-based* since models are used to precisely shape the evaluation activities. (Garzotto *et al.*, 1998)

The researcher collected criteria from various instruments and various usability approaches combined between expert and user evaluation; she held the experts phase refined the prototype for.

2.1.2.5. **Software evaluation rubrics:**

There are wide criteria on the web so that one must determine their need, their goals, and their out put. Develop a technology Evaluation form see Fig (2.2):

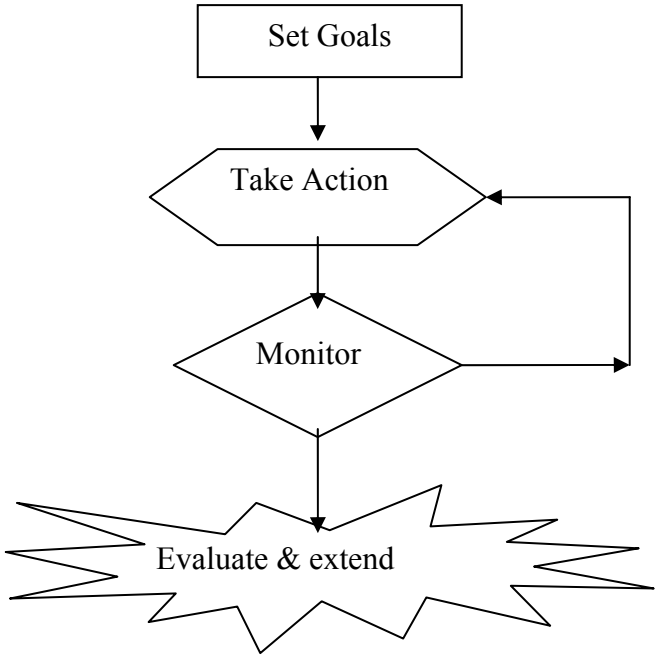

Fig 2.2: Technology evaluation form

Set goals: Design a technology evaluation form that meets your specific needs.

Take action: Collect a Variety of technology evaluation forms from magazines, journals, the web.
Monitor: Review the forms to determine which ones include criteria that important for the specific goals If you need you can return back collect more forms to met the specific goals.

Evaluate and extend: Create an evaluation form that you could use to evaluate educational soft ware (Cennamo *et al.*, 2010).

2.1.2.6. **What have to evaluate?**

There are a wide variety of forms available on the web and elsewhere; should have no trouble locating one to use or adapt the needs, the specific thing to observe in the technology, but in general one have to evaluate:

Content: is the content valid, accurate, complete, current, and appropriate to intended user?
Goals and standard: related to require learning goals and curriculum standard, and learning objective.

Intended audience: for what grade levels or ability levels.

Instructional approach: is the instructional approach compatible with you teaching style? Are there resource guides or supporting materials?

Product quality and ease of use: is it durable? Can students use it easily? Are the screen design, use of graphics, animations, sound, and feedback provide and other media elements appropriate? Are the appearance, language, text style, and graphic content appropriate for the intended audience? Are the interface logical and the software easy to use?

User support: How is technical support provided? Is there a help option available? Can you request through email or telephone support? (Cennamo *et al.*, 2010)

The researcher created the VM appreciated the content, Goals and standard, intended audience, instructional approach, product quality and ease of use.

2.1.3 **Part three. Formal and informal education**

2.1.3.1. **Learning in Informal Settings:**

Many people are motivated by intrinsic interests outside of formal learning settings. In fact, a common memory of an early science-related experience is likely to be that of an informal science event visiting a zoo or science exhibit, seeing a science program on television, talking to a scientist about his or her work, exploring nature in the backyard, or even doing kitchen "experiments" (National Science Foundation, 1998, NSF #97-20).

We need, through educational means of all kinds, formal and non-formal, to bring about a much more thorough infusion of scientific and technological culture into society.
"Informal science education "is voluntary, self-directed, and lifelong. It is learning that provides an experiential base and motivation for further activity and learning. NSF's Informal Science Education (ISE) program supports projects in which "learning is... motivated mainly by intrinsic interests, curiosity, exploration, manipulation, fantasy, task completion, and social interaction. This informal learning can be linear or nonlinear; often is self-paced and visual- or object-oriented" (National Science Foundation, 1997, p. 8, NSF #97-20).

Learning occurs in a variety of settings. It can be a result of watching TV, reading a book, playing computer gamed, or listening to a lecture. Learning in informal settings, such as science museums, science centers, zoos, typically occurs as a result of unplanned interactions. Informal science education captures the opportunities for teaching and learning science in the places and spaces of our lives. It refers to both casual and planned experiences. The settings may include science and natural history museums, zoos and botanical gardens, parks and playgrounds, community and youth organizations, and media—radio, film, video, books and magazines, television, and the Internet. Or the kitchen, backyard, and pizza parlor**.** (Wahl, 2002)

2.1.3.2. **Comparison of Informal and Formal Learning:**

Wellington (1990), Beckett and Hager (2002), summarized some of the differences between formal and informal learning environments, as shown in Table (2.1) Interactions in informal settings are voluntary, haphazard, organic/holistic, contextualized, activity- and experience-based, open-ended, unplanned, and with many unintended outcomes. In contrast, interactions in formal settings are compulsory, structured, more close-ended, planned, single capacity focus, e.g. cognition, decontextualised, Passive spectator and with fewer unintended outcomes.

Table 2.1: Comparison of Informal and Formal Learning in Science Adapted from (Wellington, 1990), and (Beckett and Hager, 2002, p128).

Formal Learning	Informal Learning
Single capacity focus, e.g. cognition	Organic/holistic
Decontextualised	Contextualised
Passive spectator	Activity- and experience-based
An end in itself	Dependent on other activities
Stimulated by teachers/trainers	Activated by individual learners
Individualistic	Often collaborative/collegial
Compulsory	Voluntary
Classroom and institution based	Outside of formal settings
Structured and sequenced	Unstructured, no sequenced
Assessed, degree granted	Non-assessed, no degree granted
More closed-ended	Open-ended
Planned	Unplanned
Fewer chance outcomes	Many accidental outcomes
Social aspect less central	Social aspect central.
High ‘currency’	Low ‘currency’
Legislated and directed (controlled)	Undirected, no legislated for

Informal Science is fun Learning is joyful. Informal science education brings out the wonder and shares the amazement of discovering the secrets of life on earth and the universe beyond. Everything is food for investigation, and the informal environment gives us the freedom to support children’s interests and questions. The fun we’re talking about isn’t just games and play. It includes serious study and concentration and hard work. But that seriousness isn’t imposed on the children. It comes from their interest and desire to know. To be able to know something deeply and do something well is satisfying (Wahl, 2002).

2.1.3.3. **NSTA and informal learning:**

National Science Teachers Association (NSTA, 1999) recognizes and encourages the development of sustained links between the informal institutions and schools. Informal science education generally refers to programs and experiences developed outside the classroom by institutions and organizations that include:

- children’s and natural history museums, science-technology centers, planetariums, zoos and aquaria, botanical gardens and arboreta, parks, nature centers and environmental education centers, and scientific research laboratories

- media, involving print, film, broadcast, and electronic forms
- community-based organizations and projects, including youth organizations and community outreach services

Informal science education institutions have a long history of providing staff development for teachers, and enrichment experiences for students and the public. Informal science education accommodates different learning styles and effectively serves the complete spectrum of learners: gifted, challenged, non-traditional, and second language learners.

2.1.3.4. **National Science Education Standards:**

- Informal science education complements, supplements, deepens, and enhances classroom science studies. It increases the amount of time participants can be engaged in a project or topic. It can be the proving ground for curriculum materials.
- The impact of informal experiences extends to the affective, cognitive, and social realms by presenting the opportunity for mentors, professionals, and citizens to share time, friendship, effort, creativity, and expertise with youngsters and adult learners.
- Informal science education allows for different learning styles and multiple intelligences and offers supplementary alternatives to science study for non-traditional and second language learners. It offers unique opportunities through field trips, field studies, overnight experiences, and special programs.
- Informal science learning experiences offer teachers a powerful means to enhance both professional and personal development in science content knowledge and accessibility to unique resources.
- Informal science education institutions, through their exhibits and programs, provide an effective means for parents and other care providers to share moments of intellectual curiosity and time with their children.
- Informal science institutions give teachers and students direct access to scientists and other career role models in the sciences, as well as to opportunities for authentic science study.
- Informal science educators bring an emphasis on creativity and enrichment strategies to their teaching through the need to attract their noncompulsory audiences.
- NSTA advocates that local corporations, foundations, and institutions fund and support informal science education in their communities.
- Informal science education is often the only means for continuing science learning in the general public beyond the school years. (NSTA, 1999)

2.1.4 **Part four. Science, Technology literacy and Society**

2.1.4.1. **Science and technology difference:** Science and technology are the two separate human culture activities. The birth of technology precedes that of science by almost 6000 years. The beginning of technology can be traced back to the old stone ages. The Greeks were the first to conceive of science as a body of knowledge:

Foecke as mentioned in Gupta (1995) definition of Science as the organized body of knowledge which attempts to explain phenomena, natural or man made. And definition Technology as the reservoir of techniques, materials, device, etc. which have demonstrated usefulness in achieving various tasks. This technological reservoir is built up through creative process of designing or problem-solving. In few words science is the understanding and continuous exploration of the natural world. Technology is applying the outcome of scientific

principles to innovate and improve the man-made things in the world. The output of Technology is a new or better process of doing.

Bybee (2000) distinguish inter science and technology; since science generates knowledge for its own sake, proposing and testing explanations. Technology, on the other hand, develops human-made solutions to real-world problems. Of course, science uses technology to generate knowledge and technology uses scientific knowledge to generate solutions, so the two are integrally connected; but they are different fields driven by different concepts and processes.

2.1.4.2. **Scientific literacy:**

Adams (1990) defined scientific literacy (SL) as an understanding of the nature and limitations of science; the basic concepts, principles, laws and theories of science; the technological applications of science; the value of science as a supplier to a decision-making process on the major societal issues of our time; and the uses of scientific knowledge in public policy decisions.

Scientifically literate person is one who: 1. has knowledge of major concepts, principles, laws and theories of science and technology applies these in appropriate ways; 2. uses the process of science and technology to solving problems and make decisions; 3. understands the nature of science and technology; 4. understands the role of science and technology in society; 5. has developed science and technology related skills; 6. process attitude and values of science, technology and free society; 7. has developed interest that leads to a richer and more satisfying life and a life that will include science, technology, and life long learning (Gupta ,1995).

Created Virtual Museum for science with different rooms (experiments to do at home, facts, scientific history, and technological of science…) could help the children build scientifically literacy as building a concept in the subject, using the process, understanding the natural of science and technology.

2.1.4.2. **Technological literacy:**

2.1.4.3. **Standards for Technological Literacy:**

The product of lengthy and careful collaboration among educators, engineers, and scientists conducted by The International Technology Education Association (ITEA) Technology for All Americans Project (TfAAP), 20 cognitive and process standards are grouped in 5 categories:

1. The Nature of Technology characteristics and scope of technology; core concepts of technology; the relationships among technologies and other fields.
2. Technology and Society cultural, social, economic, and political effects of technology; effects of technology on the environment; role of society in the development and use of technology; influence of technology on history.
3. Design attributes of design; engineering design; role of troubleshooting, research and development, invention and innovation, experimentation in problem solving.
4. Abilities for a Technological world apply the design process; use and maintain technological products and systems; assess the impact of products and systems.

5. The Designed world medical technologies; agricultural and related biotechnologies; energy and power technologies; information and communication technologies; transportation technologies; manufacturing technologies; construction technologies (ITEA, 2000).

2.1.4.4. **The need for a scientifically and technologically literate society:**

Project 2000+ is proposed to make governments and NGOs aware of the changing world, the need for science and technology education to change with it, and how this might be attempted.

> Project 2000+ recognizes the growing need for a scientifically and technologically literate society and seeks to: (a) identify ways of promoting the development of scientific and technological literacy for all (b) create educational programmed (both formal and non-formal) in such a way as to empower all to be able to satisfy their basic needs and also be productive in an increasingly technological society (c) encourage the formation of national task forces involving personnel from Government as well as Non-Governmental Organizations (NGOs) to initiate programmed for greater scientific and technological literacy and to identify and support projects which promote the desired aspects of scientific and technological literacy. (d) Support the development of a wide range of projects that aim to improve the quality of life and productivity in society, and that lead to promoting solidarity and cooperation in achieving scientific and technological literacy for all. (e) Provide guidelines for the continuous professional development of science and technology educators and leaders. (f) Support the evaluation of existing and projected programmed to ensure scientific and technological literacy goals are being met. (Holbrook, *et al*. 2000)

The International Society for Technology in Education (ISTE, 2007) declared that communication and collaboration standard leads students to learn how to communicate and collaborate using emerging technology mediums, such as online social networks. The ISTE standards also state students will "demonstrate self liability for lifelong learning. And apply digital tools to gather, evaluate, and use information.

2.1.4.5. **Scientific and technological literacy implies:**

(a) the development of scientific and technological attitudes, approaches and skills which are necessary to cope with a rapidly changing environment and which are useful for problem - solving and decision - making in daily life; (b) an approval of the nature of science and technology, and the development of positive attitudes and values relating basic science and technology to other areas of human activity; (c) coverage effective teaching strategies and relevant examples of science and technology at (primary, secondary, or adult education) either within a formal programmed, or through non-formal or distance education methods); and (d) familiarization with processes of accessing and communicating science and technology information and motivation to use it to meet personal, local or global requirements. (Whittle & Maharjan, 2000)

2.1.4.6. **Creating the STL teaching material:**

In order to create the STL teaching material (Scientific Technology literacy) proposed objectives are put forward in each of these four areas, at least one objective in each of the areas, and given in this sequence: Social values; Science method; Personal skills; Science concepts.

Allow participants to add educational objectives in each of the four areas mentioned that relate to the title of the script chosen. One can of course have more than one educational objective per area necessary, but for the material to be STL there needs to be at least one objective stated for each of the four areas (Holbrook *et al.,* 2000).

2.1.4.7. **Evaluation of STL materials:**

In order to evaluate STL materials it is necessary to establish if any of the following goals have been achieved among the target population:

- Educate children on matters concerning the environment to the extent that childhood itself will be an example of sustainable development.
- Persists to create environmental awareness, insure public participation
- Adopt a more sustainable approach to life and transmit this to the family community and particularly the up-coming generation.
- Perceives a common future for society.
- Acts both individually and as a group towards that end.
- Realizes that individuals have a moral obligation to support towards the common goals of the community. Be familiar with, no instruments have yet been developed exactly for this purpose (Whittle and Maharjan, 2000).

In order to Create STL Virtual Museum should satisfy at least one objective in each of the areas: Social values; Science method; Personal skills; Science concepts. Creation VM with various rooms such as: 1. Technological of science with some explanations to build instruments and tools like telescope, Camera and how they are worked; 2. Experiments at home 3. Useful link may help children build scientifically and technology literacy in informal manner.

2.1.4.8. **The student activities in STL materials:**

The student activities can be varied and can include: Individual writing, drawing, or presenting; group work for discussion; undertaking experimental work; developing a presentation; formulating a point of view; creating a questionnaire; undertaking a library search; brainstorming; planning class actions; writing letter to the community leaders; poster for public awareness; participating in a play, a class debate, or a simulation of a law court decision making process. (Holbrook *et al*, 2000)

2.1.4.9. **STS programmed:**

The present highly technological society has its specific problems. Scientific illiteracy among members of such a society is considered a significant obstacle in the positive growth or dynamic evaluation of that society. Science and technology Education has become an integral part of school curriculum in all over the world. (Gupta, 1995).
A new movement the Science-Technology-Society (STS) initiatives in North America were some of the early attempts to bring meaningful scientific experiences to a wider population - science for all (Whittle & Maharjan, 2000).

2.1.4.10. STS programmed were characterized by having:

- Students identify with problems of local or personal interest
- Local resource materials and real-life problems
- Active involvement by students in seeking solutions to problems
- An emphasis on process skills of use to the students
- Opportunities for students to adopt decision-making roles
- A focus on the impact of science and technology on everyday life. (Whittle and Maharjan, 2000).

2.1.4.11. STS website evaluation:

For the purpose of STS website evaluation, can be reformulated into six questions: 1.Does the site help build vocabulary on the topic? 2. Does the site help build an understanding of the scientific processes involved in the topic? 3. Does the site help build an understanding of the impact the topic may have on society? 4. Does the site discuss the tools (either hardware or software) that are used in researching the topic? 5. Does the site help build an understanding of how the resources relevant to the topic are organized and accessed? 6. Does the site help build an understanding of the social context in which the scientific work is done? Each of these questions may be given more weight or less weight depending on the webliography's intended audience**. (**Welborn and Kanar, 2000)

2.2 Section two previous studies

This section reviews the previous studies; it is divided into four parts. The first part reviews previous studies related to *VM*. The second part of the chapter reviews previous studies related to effective design and usability of the software. The third part of the chapter reviews studies related to informal environments. The fourth component of the chapter looks at the previous studies related to science, technology and society literacy.

2.2.1 Previous studies related to *VM*

Shim *et al* (2003) declared that the potential of virtual reality (interactivity, engagement, and remote access for learners) in biology education is enormous, as they are examined the effect of the virtual reality biology simulation (VRBS) on knowledge achievement, using two classes (one used the VRBS and the other used videos) of middle school students. Knowledge achievement scores at the pretest level were not significantly different between these two groups. At the posttest level, the scores of the VRBS group were significantly higher than the control group taught using videos. More than 50% of students said that studying biology using the VRBS provided enjoyment, having a sense of *reality* and an ease for understanding biological concepts.

Prosser and Eddisford (2004) examined children's and adults' attitudes to virtual representations of museum objects. On empirical research data gained from two web-based digital learning environments "Burma" and the Virtual Victorians project developed in UK primary schools. The relationship between the virtual object and the physical object was examined; The Burma data was collected from a single year 3 (age 7-8) class in a local infants' school by non participant observation of the class at work, followed by semi-structured interviews with some of the children in the class. The children were selected by convenience sampling, with ensured an equal gender balance. The class teacher was also interviewed during this project, analyzed copies of class work, and feedback forms from parents collected. Twenty teachers who had used the site with their classes were asked to complete feedback forms; 18 responses from teachers, eight from children, 12 from parents and two from museum professionals. This data has been analyzed and coded. In addition content generated as a result of interaction with the site has also been analyzed and coded. The findings from Burma and Virtual Victorians show that the virtual objects did not diminish but promoted an appreciation of the value of physical objects and of displaying them in museums.

Lepouras *et al* (2004) demonstrated findings gathered from the creation of a multi-thematic virtual museum environment to be offered to visitors of real world museums. Participants On the basis of the experiment were visitors of the Museum of Zoology who volunteered to take part in the assessment. A total of 25 subjects, 14 male and 11 female, participated in the experiment. The subjects were mostly students and researchers of the University of Athens. At the end of the experiment participants completed a questionnaire. The questionnaire consisted of two parts: a part with user profile questions and a part with questions regarding the user's experience. In the second part, questions concerned the design of the environment, the details, the layout, the positioning of exhibits and the use of input devices for the experiment tasks; the questionnaire concluded with questions evaluating the user's overall experience. In the

majority of questions, users had to rate aspects of the corresponding issue; in some cases they had to note their preferences, while an open-ended question, where the participants could make any comments they liked, also existed, the notes recorded by the evaluator and the video of the participants' interaction, a number of issues were identified. In response to experimental findings, circulation spaces (paths and halls) have been redesigned and the user's ability to move and rotate has been appropriately constrained. The paper is concluded with insights gained from the development of the virtual museum and portrays future research plans. The designer has to develop an intuitive, consistent, user-friendly, stimulating virtual environment, with rigid hardware, able to withstand heavy, everyday use. The researcher has taken this recommendation in her priority.

Ang and Wang (2006) purposed to explore how the three-dimensional (3D) Virtual Learning Environment (VLE), Active Worlds, could engage underachiever students in learning the scientific concept of the Solar System. A group of ten underachiever students from the primary 5 grade; at a neighborhood school in Singapore; were selected to participate in this study. They were tasked to make use of Active Worlds to build 3D objects that could display information correctly about the Solar System. Data were collected by using lesson observations, interview with students, and students' project assessment. The results showed that the students were engaged in the learning task and expected more topics. The information presented in the virtual space was accurate.

Lim and Edirisinghe (2007) shared the processes and lessons learned from a pilot project exploring the use of Second Life as a learning environment for computer science subjects. With pilot study focused upon the tutor and student at the polytechnic. The sample size consisted of two (2) tutors and forty (40) students. The tutors were selected by the subject team leaders and the students were selected using simple random sampling. The instruments used for data collection were the tutors' journals, interviews with tutors, and interviews with students. The interviews with both the tutors and students were conducted at the end of the delivery phase of the project. The results related to the students were collected based on the teaching team's observations and students' feedback. The keys results are (1) an increased level of student engagement, (2) evidence of peer teaching amongst the student avatars within SL, (3) note-cards being observed as an ineffective medium to provide instructions, (4) incorrect student expectations of SL, and (5) learning activities perceived as a good form of practice by the students. The results related to the teaching team were collected based on feedback sessions with the teaching team during the preparation and delivery of the subject. The key results are (1) SL requires a lot of hardware resources, (2) regular updates of Second Life client were disruptive to the learning environment, (3) a significant learning curve is required to master Linden script for teaching team, (4) the lack of a suitable SL compiler was problematic during the preparation period, and (5) the role of tutor during delivery became more of a facilitator. The researchers suggested that SL could be a viable learning environment. However, further explorations and evaluations will be necessary to evaluate the effectiveness of meeting the learning outcomes. Recommendation work will include expanding the learning activities to replace a tutorial class, identifying ways to streamline the preparation of learning activities, and identifying the impact SL has on learners' different learning styles.

Khaled (2008) aimed in her study to investigate the effect of employing virtual learning environment of teaching science on the sixth graders' achievement at UNRWA schools in Nablus District, The population consisted of the sixth Graders.The sample included (146) students from both sexes. Each group consisted of a class (32) male students, and another of (41) female students. An achievement test about Force and Movement was prepared, A Statistical Package of (6) virtual experiments (of the chapter about Movement and Power) was used, the contents' reliability was approved by a group of referees. The data were analyzed. The results were displayed; There were significant differences at (α=0.05) in achievement and material preservation for sixth graders between pre- and post-tests for the controlled group at all levels, and at the total degree; For the sake post-test there were significant differences at (α=0.05) in achievement and preservation for the controlled group , between pre and post tests at all levels ,and at the total degree, for the sake post –test. There were no significant differences at (α=0.05) in science achievement for sixth graders, between the two target groups pertaining preserving science material, remembering, comprehending and constructing, besides the total degree of the post test, while there were significant differences in application, analyzing, and assessment for the sake of the experimental group. There were significant differences at (α=0.05) in science achievement and preservation, for sixth graders, between the two target groups for the sake of the experimental group. The researcher recommended the necessity to employ virtual learning environment in teaching science for all graders, along with modern technology. More research concerning virtual learning environment effect on other grades, should be carried out.

As Delello (2009) declared that the creation of a virtual science museum exhibition is a process that is not completed with just the building and design, but must incorporate feedback from public audiences who utilize the exhibit. To design a museum that would facilitate a cultural exchange of scientific information, the survey data gathered was collected from an initial university survey, two summer camps in Beijing, China, an email sample from U.S. educators based upon a snowball sampling, and a questionnaire focused on both a U.S. middle school and a Chinese middle school audience. The following categories: visitor insights, the usability of the technology, the educational effectiveness of the museum exhibit, and the cultural nuances that existed between students in China and in the United States were taken. The findings of this study illustrate that the objectives of museum designers may not necessarily reflect the needs of the visitors. Even though the world has moved forwards with digital technology, classroom instruction in both China and in the United States continues to reflect traditional teaching methods. Students were shown to have a lack of experience with the Internet in classrooms and difficulty in scientific comprehension when using the virtual science museum—showing a separation between classroom technology and learning. Students showed a greater interest level in learning science with technology through online gaming and rich multimedia suggesting that virtual science museums can be educationally valuable and support an alternative to traditional teaching methods if designed with the end user in mind. So the designed of *VM* is more important than construct conception Museum developers.

Kartiko *et al* (2009) developed a series of Virtual Reality (VR) presentations to teach second-year psychology students about the navigational behavior of Cataglyphis ants with flat, cartoon, or lifelike Animated-Virtual Actors (AVAs.) To assess learning outcomes, the researcher used Program Ratings, which measured perception of learning and perceived difficulty, and retention and transfer tests. The results from 200 students did not reveal any

significant differences in presence, perceived affective quality, or learning outcomes as a function of the AVA's visual complexity. While the results showed positive correlations between presence, perceived affective quality and perception of learning, none of these correlates with perceived difficulty, retention, or transfer scores. Nevertheless, the authors' simulation produced significant improvements on retention and transfer scores in all conditions.

Anderson (2010) discussed that The Xen Worlds environment was created to provide a safe, lab environment for use in the Information Assurance (IA) graduate program at Iowa State University. Providing students with personal networks of fully functional virtual machines (VMs) The Xen Worlds environment can be provided using minimal hardware, and uses open source software, making it a low-cost option for education. Xen Worlds has several features that ensure the system is equally accessible and easy to use, even if the student has limited access to computing or network resources. To rate the usability and effectiveness of the Xen Worlds environment, student feedback was collected through the use of surveys. The surveys consisted of 9 questions, and were given to approximately 50 students, generating 32 responses - 17 from the graduate class, 15 from the undergraduate class. While both classes were an introduction to computer security. The results indicate students feel the environment is an enjoyable and effective teaching method, with comments indicating a desire for a greater number of assignments to be provided. and many students consider it a valuable tool for learning, and reinforcing class material, the assignments created for Xen Worlds cover a variety of curriculum areas. Looking forward, there are several areas of Xen Worlds that could be improved or modified, the assignment library could be expanded to include additional assignments, including more complex and open-ended assignments to increase the ways a student can explore the VM environment.

Dar Saleh (2010) found out the effect of using educational software programs in the teaching of the Arabic language on the achievement of the first graders in Nablus Governorate schools. An instrument was administered to an intentional sample of 313 male and female students in the first grade attending three types of schools: public, private and UNRWA in the academic year 2009/2010. The subjects were distributed into two groups. The first one, experimental (155 male and female), learned by using computerized lessons. The other group, control (158 male and female), learned the Arabic lessons in the traditional way. The statistical analysis revealed the following findings: It was found that there were no statistically significant differences at $\alpha = 0.05$ in the achievement of the first graders, which might be attributed to type of the group and sex, on the pretest in all the study groups. However, it was found that there were statistically significant differences at $\alpha = 0.05$ in the achievement of the first graders, which might be attributed to type of school, on the posttest in all the study groups and in favor of the private school graders, the UNRWA schools and the public schools respectively. It was also found that there were statistically significant differences at $\alpha = 0.05$ in the achievement of the first graders, in the learning Arabic language, on the posttest which might be attributed to the type of the group in each school of the sample. Achievements were in favor of the experimental group in all the sample's schools except Es-Salam Primary School for Boys. The marks of the first graders in the experimental group were not different from the marks of those in the control group in the posttest. There were also statistically significant differences at $\alpha = 0.05$ in the achievement of the first graders, in the learning of Arabic, between the experimental groups in the post- and pretests in favor of the posttest. Finally, it was found that

there were statistically significant differences at α= 0.05 in the achievement of the first graders, in the learning of Arabic, between the control groups and the experimental group on the pretest in favor of the latter. The recommendation: to use educational software programs and other new technologies to improve the output of the educational process; and to carry out further research on the use of educational software modules in other governorates and in other basic disciplines such as English, math and science.

2.2.1.1 Discussion of previous studies related to *VM*

There exist many compelling reasons for believing that virtual museum for children warrant serious investigation. The researcher has taken in her priority the recommendations of; Lepouras *et al* (2004) that the designer has to develop an intuitive, consistent, user-friendly, stimulating virtual environment; Delello (2009) the designers must find a way to capture the visitors' attention. So the designers must focus on the learner's needs and evaluations must be conducted in all phases of exhibit development, the focus of the present study. As a recommendation Lim and Edirisinghe (2007) the researcher design the VM accommodate for different learning style.

There is general agreement inter researchers that virtual museum can have strong motivational impact; this research agreed with Prosser and Eddisford (2004) convenience sample have collected feedback from teachers, children, parents. The same as Lim and Edirisinghe (2007) have taken the result from the student perspective and the teaching team's perspective. The feedback in this research was collected from experts (pedagogical, subject matter, multimedia), students and parents. The researcher agreed with: Lepouras *et al* (2004) to portray the user evaluation from the perspective of the user (student and researcher); Delello (2009) that the creation of a virtual science museum exhibition is a process incorporate feedback from public audiences who utilize the exhibit; Ang and Wang (2006) that Virtual Environment could engage underachiever students in learning the scientific concept of the Solar System. That is not completed with just the building and design, but must incorporate feedback from public audiences who utilize the exhibit. Like Anderson (2010) was rated the usability and effectiveness of the Xen Worlds environment, student feedback was collected through the use of surveys. As Shim *et al* (2003) announced that the potential of virtual reality (interactivity, engagement, and remote access for learners) in biology education is enormous.

The researcher taken Dar Saleh (2010) recommended using educational software programs and other new technologies to improve the output of the educational process. And she suggested conducting further research on the use of educational software modules in other governorates and in other basic disciplines such as English, math and science. But in this one the researcher creates suitable software program to science lower basic grade taken their evaluation to put them in the center of learning process.

In a few word this research refined the *VM* from the perspective of experts (pedagogical, subject matter, multimedia); portray how user evaluation (parents and students) were able provided reflective feedback through instruments of evaluation analysis, contributing to a new and better-designed museum. Five concepts were taken in depth from the curriculums of the lower basic grades to produce interactive, enjoyable, user-friendly *VM*, and should assure the STS.

2.2.2 Previous studies related to Effective design and usability of the software

Evans and Sterry (1999) aimed to design an interactive multimedia application for a virtual museum setting, to assess the application as an aid to interpretation and to examine its impact on the visitor's understanding and enjoyment of the virtual museum experience final phase: is to examine the potential applications of new technologies for science attractions and museums. The interactive multimedia application developed for this research project was tested by multimedia developers based at the University of Salford, who were shown the prototype at an early stage, in order to gain feedback from other experienced multimedia designers. During its development, the prototype was also extensively tested with different user groups including general museum visitors and museum staff. Feedback was obtained via informal discussion and observation. A usability test where by visitors in the gallery were asked to use the portable computer for a short time and then asked specific questions was used to clarify user friendliness of the interactive multimedia application and at the same time to establish opinion on the portable computer. Again, observation and informal conversation provided feedback. Such testing continued throughout the development stages of the prototype with refinements and adjustments made as appropriate.

In addition the gallery curator, demonstrators and interactive designer also tested the application during the design stages and after completion of final revisions to check that the program material and context was correct. a multi-method approach, combining pre-visit and post-visit questionnaires, structured unobtrusive observation and interaction log recording were used to gather both quantitative and qualitative data. Visitors' opinions of the portable computer when questioned over 90% of visitors from the computer group expressed the opinion that they had enjoyed using the portable computer and that it had been easy to use. The touch screen was identified by 56% of visitors as significantly contributing to ease to use. Other elements mentioned positively regarding ease of use were the flexible and straight forward structure of the application, clear buttons, help system and the location map. The Videos/Animations were the most liked feature of the multimedia application, being identified by 44% of visitors. Also mentioned positively was the access to information, ease of use, visual screen design and audio narration. The least liked aspect of the portable computer was that it was too heavy, as identified by 46% of visitors. Few visitors commented that they thought the computer distracted from the exhibits. However 84% of visitors expressed the opinion that they had explored the textile machines in more detail using the computer, and 92% that they had learnt more using the computer than they would have done otherwise.

Cantón *et al* (2006) presented a methodology for creating resource and its application to the Learn Project. The overall objective is to build up and develop the physical, emotional, cognitive and communicational skills of learners with special educational needs, using new information and communications technologies to promote, to the greatest possible extent, their personal autonomy and social integration. It includes an alternative curriculum adapted to learners' needs. The resource is composed of a web site and an application. The web site is divided in three sections: teachers, parents and learners. The learners section includes multimedia activities organized by learning objects: skills, difficulty levels and real-life situations. Three different profiles were established for the *Learn Project*: *contents developers* are pedagogues and educators, whose mission is to prepare the contents; *graphics developers*

produce the graphics and audiovisual material; and *technical developers* are software engineers and programmers who develop the new adaptive tools. All of them had to "think like the learners". A group of pedagogues was appointed to test the resource. They have made use of real users and assistive technologies in the many tests run. The WAI Webxact and HERA (Spanish assessor) guidelines evaluators have been used to evaluate accessibility of web pages. Certain children were considered as the target of this project, viewed from an integrative viewpoint, they have special educational needs, and they are going to need particular teaching aids to achieve their educational goals. Therefore, what will shape a child with special educational needs is not its impairment but the conditions affecting its personal development, and this justifies the provision of certain out of- the-ordinary teaching aids or educational services, of which this project is part.

Tselios *et al (2007)* in there paper focuses on usability evaluation of information and communication technologies applications in education (ICTE applications). Various classes of teaching and learning systems are discussed in terms of technologies used and pedagogical approaches. Their usability is analyzed according to various dimensions and the impact of system usability on the learning effectiveness is studied. The researcher argue that various classes of ICTE applications such as multimedia/hypermedia applications, open educational environments and CSCL environments, based on different theoretical perspectives, require fundamentally different approaches in evaluating their usability. There paper is structured as follows: an overview of different usability evaluation approaches is presented first, followed by a discussion on applicability of these techniques in various categories of teaching and learning computer systems. Typical case studies that engage both usability experts and users themselves (students and teachers) are also discussed. The objective is to describe both the methods, and the way to apply them effectively in order to certify the usability of an ICTE application with respect to its teaching and learning objectives.

Pribeanu *et al* (2009) described both experiments and compare the usability evaluation results for the development of Augmented Reality (*ARTP)*. This work presents an approach to the user-centered usability evaluation of an e-learning scenario for Biology developed on an Augmented Reality Teaching Platform the mix of real and virtual. The evaluation has been carried on during and after a summer school held within the ARiSE (Augmented Reality for School Environments) research project. The basic idea was to perform usability evaluation twice. In this respect, the researchers conducted user testing with a small number of students during the summer school in order to get a fast feedback from users having good knowledge in Biology. Then, the researchers repeated the user testing in different conditions and with a relatively larger number of representative users. A usability questionnaire has been developed that is based on existing user satisfaction questionnaires, The questionnaire has 28 closed items (quantitative measures) and 2 open questions, asking users to describe the most 3 positive and most 3 negative aspects (qualitative measures).

This evaluation instrument provides with 24 items that are targeting various dimensions such as ergonomics, usability, perceived utility, attitude and intention to use. The remainder four items are to assess how the students overall perceived the platform as being easy to use, useful for learning, enjoyable to learn with and exciting. Measures were collected for all exercises performed. After testing, the students were asked to answer the new usability questionnaire. Prior to the summer school, the questionnaire has been translated in the native language of

students. Data collected with the usability questionnaire reveals several positive aspects. ARTP has educational value: the system is good for understanding, good for learning, good for testing, and makes it easier to remember the lesson. The system makes learning faster. ARTP is increasing the students' motivation to learn: the system is attractive, stimulating and exciting, exercises are captivating and the system makes learning less boring. The students liked the interaction with 3D objects using AR techniques as well as the vocal explanation guiding them throughout the learning process. Overall, the user acceptance of ARTP was good: students appreciated ARTP as useful for learning and expressed the interest to use it in the future. Several usability problems exist that have been identified. The clarity of the visual perception should be improved as well as the overall ease of use.

Pandith *et al* (2009) described an exploratory study that analyzes the impact of change in software on users by utilizing the Critical Incident Technique (CIT). A total of 102 critical incidents were collected from the survey. 77 participants reported both satisfactory and unsatisfactory experiences; 22 reported only satisfactory experiences; and 3 reported only unsatisfactory experiences. Analysis of satisfactory or unsatisfactory experiences revealed several factors such as expectations of users and mismatch in the behavior between the actual and anticipated system by the users, which can be attributed to automation surprise. The important findings of this study are the agglomeration of user feedback such as, avoiding the changes themselves in the first place, focusing on the factors of change viz. amount of change, speed of change, and finally, to provide better help support, which can be used in the design process when there is a change in software. As recommendation Software designers should keep the usability of all target users in mind before changing versions.

Laghos (2010) aimed to create an educational game with the purpose of assisting children in their school learning activities. Specifically, this game is targeted to be used by elementary school children so that they can practice mathematics and also obtain some general knowledge about animals. The application serves as a pilot study and was tested by a convenience sample of 21 students, sometimes with the help of their parents. The primary task was to provide feedback on the game's interface, usability and acceptance by the children. The students were given the CD and had a chance to play the game for a few days. After that, informal interviews were carried out with the children and their parents enabling free conversations to develop where they could say what they liked about the game, what they didn't like, what they would change, and what additional features they wanted. The children liked the colors and animations in the game, as well as the playful tunes accompanying it. However it was noted that some more characteristic sounds could have been used as feedback on correct and incorrect answers in addition to sounds being used when buttons or images were clicked. Furthermore, there were suggestions for brief instructions prior to each part of the game explaining how the game is played, although overall, the children found it relatively easy to learn how to play it. The parents were also helpful in providing feedback. The stages of the application's design, implementation and evaluation are presented. Strengths of the game are identified and discussed, and its weaknesses are identified, allowing for suggestions for future redesigns. The results show that the use of games can engage children in the learning process for longer periods of time with the added benefit of the entertainment factor.

Pappa and Pannese (2010) discussed the inherent challenges of building intellectually appropriate and engaging games and present the methodology adopted in the case of the e-

VITA project that applies GBL Game-Based-Learning to promote knowledge sharing and transfer for intergenerational learning; the e-VITA frameworks for SGs development and evaluation. Game development is regarded as a c process that builds on continuous evaluation and improvement and the active involvement of users in European countries (Spain, Portugal, Poland, Italy, Greece, UK) use of questionnaires with targeted interviews. The e-VITA evaluation framework includes three main analysis dimensions: technical verification, User Experience evaluation and pedagogical aspects evaluation (evaluation of learning outcome). Failing to meet the requirements of one dimension could compromise the effectiveness of learning. The use of technology for instruction is in its infancy. Experienced gamers (mostly under 20 male participants) could easily get familiarized with the game, finding their way around intuitively without need for guidance, but at the same time had "false" expectations of the game, During the survey, these players demonstrated lower motivation rates and reluctance in repeating the gaming experience, being disappointed by the "lack of action" in the game. Nonetheless, when they were asked whether they would accept such a game as part of their school curriculum, their views shifted and the acceptance rate rose. The result stresses the need for a balance between education and entertainment in educational games: although a serious game is a game in which education is the primary goal, rather than entertainment, the potential of technology to create engaging experiences should be exploited, always taking into consideration the expectations of the players. In order to assess the usability and student

2.2.2.1 Discussion of previous studies related to Effective design and usability of the software

Evans and Sterry (1999) tested the interactive multimedia by multimedia developers A usability test where done by visitors; specific questions was used to clarify user friendliness of the interactive multimedia application. Testing continued throughout the development stages of the prototype with refinements and adjustments made as appropriate. The researcher agreed with the idea of Cantón *et al* present (2006) that three different profiles associated in the *Learn Project contents developers* are pedagogues and educators, whose mission is to prepare the contents; *graphics developers* produce the graphics and audiovisual material; and *technical developers,* but in this research the three one are evaluators not builder. The learners section includes multimedia activities organized by learning objects: skills, difficulty levels and real-life situations, like this research. The researcher as Tselios *et al (2007)* studied engages both usability experts and users themselves (students and teachers). Pribeanu *et al (2009)* idea was to perform usability evaluation with usability questionnaire. Pandith *et al* (2009) described an exploratory study that analyzes the impact of change in software on users by utilizing the Critical Incident Technique (CIT). Laghos (2010) provided feedback on the interface, usability and acceptance by the children; informal interviews were carried out with the children and their parents. Pappa and Pannese (2010) evaluation framework includes three main analysis dimensions: technical verification, User Experience evaluation and pedagogical aspects evaluation (evaluation of learning outcome). In order to improve learning and motivation, educational games design should target all three dimensions. Failing to meet the requirements of one dimension could compromise the effectiveness of learning combine the use of questionnaires with targeted interviews.

In few worlds the researcher continued evaluation throughout the development stages of the prototype with refinements and adjustments made as appropriate. Experts (pedagogical, multi

media, and subject matter) and users (parents, students) whose operation was to evaluate the VM. Perform VM evaluation with evaluation instruments. Focus interviews were carried out with the children, User Experience evaluation and pedagogical aspects evaluation evaluating the interface, usability, enjoyable, STS assured and acceptance of the VM, A specific evaluation instruments were used to clarify user friendliness, enjoyment of the interactive VM.

2.2.3 Previous studies related to informal environments

Hendrix (1985) addressed primary question was to what extent can sociodemographic characteristics explain Participation in Adult Education (PAE). PAE was operationalized as three distinct activities, *science* and *technology museum* visitation (STMV), *science* magazine reading (SMR), and *science* television program viewing (STPV). Given these three processes for informal *science* education, this study asked what the structural relationship of participation in STMV, SMR, and STPV was. To address the research questions, secondary analysis of a national data set was completed, it was demonstrated that STMV and SMR, sociodemographics provided substantial explanation of differences observed. For STPV, interest in *science* or technology demonstrated explanatory power exceeding that of sociodemographics.

Overall, the best predictors of participation in informal *science* education were level of formal education and interest in *science* or technology. The same general pattern of associations between sociodemographics and PAE were demonstrated in relation to participation in informal *science* education as those observed in relation to participation in organized instruction. However, different characteristics were associated with PAE depending upon its operationalized form. The study concluded that sociodemographics can substantially explain PAE when it is operationalized as a specific activity dealing with a specific topical area, and when the methodology employed is substantively compatible with the question being asked. The process defined by the study is suggested as the appropriate way to study PAE. It provides explanations that are conceptually meaningful and profiles of the "typical participant" served by the particular form of adult education studied.

Maher and Corbit (2002). A team of developers at the Cornell Theory Center (CTC), Cornell University's high performance computing and interdisciplinary research center, has implemented a 3D multiuser virtual science museum, SciCentr. SciCentr is a virtual world based on Active Worlds client/server technology. Related to gaming technology and thus attractive to youth, virtual environments can be applied to formal and informal science education in areas such as genetics, as well as to language learning and social studies. In this paper, the researchers review the current state of their understanding of the impact of this technology on informal science learning. They attempt to identify some of the advantages of using this technology, design features of their implementation, and ideas for managing the social interaction among educational users. More specifically, they have discussed pilot user experiences focused on crop genetics in SciCentr's Plant Breeding Beds and on the related SciFair exhibits, both examples of collaborative experiences in our virtual worlds. Finally, they describe the next stage in interactive interface development for their Gene Bot feature. their experience working with pilot users in both SciCentr and SciFair have shown that students and researchers alike become `captured' by a virtual environment that engages them and enables them to collaborate at a distance with college student mentors and guides. they

have learnt that the youth can become engaged and in fact self-motivated in their exploration of an advanced area of science.

Frensh (2007) examined learning in Kansas City's Science City's *Astronaut Training Center* in order to identify specific behaviors associated with visitors' perception of learning and their attitudes toward space and science to develop an effective chemistry exhibit. Grounded in social-constructivism and the Contextual Model of Learning, this work approaches learning in informal environments as resulting from social interactions constructed over time from interaction between visitors. Visitors to the *Astronaut Training Center* were surveyed both during their visit and a year after the visit to establish their perceptions of behavior within the exhibit and attitudes toward space and science.

Observations of visitor behavior and a survey of the Science City staff were used to corroborate visitor responses. Eighty-six percent of visitors to Science City indicated they had learned from their experiences in the *Astronaut Training Center*. No correlation was found between this perception of learning and visitor's interactions with exhibit stations. Visitor attitudes were generally positive toward learning in informal settings and space science as it was presented in the exhibit. Visitors also felt positively toward using video game technology as learning tools. This opens opportunities to developing chemistry exhibits using video technology to lessen the waste stream produced by a full scale chemistry exhibit.

Phipps (2008) discussed the state of Free-Choice Learning research, and an investigation into the use of personal ubiquitous technology on visitors' experiences at a science center. Phipps study approached in two phases; the first phase follows the principles of design research in exploring ways to present the iPods within the most favorable context to encourage learning. These changes were systematically implemented and their impact on visitors' experiences was documented. The second phase of the research focused on one particular exhibit and three accompanying videos on the iPod. This exhibit is well loved, but difficult to understand for visitors and docents alike. Through naturalistic inquiry and iterative open coding, the researcher found visitors interpreted appropriate use of the exhibit in four distinct ways: How does it work? How waiting for the splash interacting and resting. However, iPod users all interpreted appropriate use of the exhibit as how does it work? Careful observation of visitors' actions at the "Chaos Wheel" exhibit suggests that the exhibit needs some revision if it is to become more accessible to more visitors. The iPod represents one way to increase the accessibility of the exhibit, but other means should be explored.

As Kralina (2009) mentioned that Extra Curricular Activities (ECA) are settings offering free-choice experiences that are generally voluntary, open-ended, non-sequential, self directed, hands-on, and evaluation-free. This mixed methods study investigates participation in a high school science ECA by collecting the memories of former student members for their perceptions of engagement as well as social positioning. First, this study examines the levels in which the science club engaged these members, particularly females, in science and teaching. Second, the study also ascertains how participation in the club allowed members to explore new identities and fostered the development of new skills, actions and behaviors, expanding possible future trajectories of identification, specifically in science- and education-related career fields. A theoretical framework has been constructed, based on seven essential

elements of informal learning for an engaging as well as a socially constructive high school science ECA.

The most significant findings are 1) the high correlation between engagement, specifically, cognitive engagement with social positioning, 2) the important role of emotional engagement in science ECA, 3) the major perception roadblocks to science learning that can be overcome, particularly for females in physical science, and 4) the importance of the teacher-student interactions in science ECA. Articulating a theoretical framework to legitimate the power of informal learning structures may help other educators to understand the potential benefits of science ECA and thus, increase opportunities for such experiential activities in order to enhance engagement and expand positioning of their students in science. More engaging, socially constructive science ECA has the potential to enhance science education.

2.2.3.1 Discussion of previous studies related to informal environments

The researcher agreed with Maher and Corbit (2002) of the advantages of using virtual science museum technology on informal science, design features of their implementation, and ideas for managing the social interaction among educational users. Phipps (2008) Examine visitors' interest in using handheld computers (iPods) for learning in a science museum, and report on refining protocols for this type of research. Investigate the impact of using an iPod with supplementary videos on visitors' use and understanding of an exhibit on scientific chaos free choice learning. As Kralina (2009) mentioned that Extra Curricular Activities (ECA) are settings offering free-choice experiences that are generally voluntary, open-ended, non-sequential, self directed, hands-on, and evaluation-free. His mixed methods study investigates participation in a high school science ECA by collecting the memories of former student members for their perceptions of engagement as well as social positioning. Frensh (2007) examined learning in Kansas City's Science in order to identify specific behaviors associated with visitors' perception of learning and their attitudes toward space and science to develop an effective chemistry exhibit, grounded in social-constructivism and the Contextual Model of Learning. Like hendrix (1985) determine that PAE in science and technology museum visitation as informal teaching.

The researcher created the VM as a tool for STS in informal education. In a few word created the VM from perspective of students, the concept from the curriculum in informal learning. The researcher examines the content and the design and the interest in using the VM as informal teaching, from the perspective of participant (experts and users) and refining the design. Created science VM as informal environment.

2.2.4 Previous studies related to science, technology and society literacy

Yörük *et al* (2009) declared that the reformed science education programs in Turkey aim to guide the individuals to be scientifically and technologically literate. Through enabling an individual, who is in a technological media, to attain the required knowledge, skills and attitudes, the individual should have the "science and technology literacy and creative thinking" skills. Individuals should recognize the technological environment they live in as well as the dimensions and facilities of technology, and should be aware of the fact that they could make use of these opportunities. In the light of this aim, this study involves the teaching

of "separating mixtures" to 9th grade students in relation with science, technology, society and environment and the examination of its possible effects on students' achievement as well as their career choices. The Chemistry Achievement Test and the Career Choice Questionnaire were administered as pre- and post-test to serve as data collection tools. The study concluded that chemistry education in relation with science, technology, society and environment would lead students to choosing different fields for their future careers by changing their perspectives towards science. A significant increase in students' chemistry achievement levels was also observed.

Fleischmann (2007) studied the issue of educational standards in practice through studying how standards shape the design, marketing, and use of educational computer simulations. Data from a variety of sources, including semistructured interviews, participant observation, and content analysis of software and promotional materials are used examine the impact of science and technology standards on educational software design, marketing, and use. The larger case study that informs this paper included 51 interviews, including 14 designers of six frog dissection simulations (some of whom currently are or previously were biology teachers), 29 users of frog dissection simulations (including three biology teachers, a principal, and 25 biology students), and 8 animal advocates who play a role in marketing dissection simulations.

The data collected for this study provide evidence that science and technology standards have a strong influence on the use of educational simulation software in biology classes, and this influence may be growing. When designing simulations, designers must be mindful to match the content of their simulation to existing educational standards. In this case, the standards seem to have robbed the software designers to some extent of their creativity, and certainly of their intellectual freedom to develop content, since they must develop content specifically to meet standards. Educational standards also have a significant impact on the marketing of educational simulation software. Interviews with students revealed a variety of perspectives on the issue of alternatives to dissection, ranging from emphasis on student choice to a preference for required dissection. This issue has direct relevance on the design of educational software, since educational standards reduce not only teachers' ability to meet the specific needs of their students but also designers' ability to innovate and produce products that are relevant to particular target audiences.

Scherz and Oren (2006) examined the images middle school students have of science and technology, the workplaces, and the relevant professions. It also describes the effect on these images caused by an instructional initiative, "Investigation into Science and Technology" (IST), designed to introduce students to science and technology in the "real life." Students' images were delineated via questionnaires, drawing tasks, and interviews before and after their participation in the IST program. The sample consisted of ~100 students from six classes (eighth or ninth grade) of three schools. The researchers found that before the IST intervention students' images about the scientific or technological environments were superficial, unreal, and even incorrect. Their impressions of the characteristics of scientists and technologists were superficial, misleading, and sometimes reflected ignorance. The findings demonstrate that the IST program stimulated a positive effect on students' images. Their preconceptions were altered in several dimensions: in "the cognitive dimension," from superficial and vague

to precise and correct images; in "the perceptive dimension," from stereotypic to rational and open-minded images; and in "the affective dimension," from negative to positive attitudes.

2.2.4.1 Discussion of the studies related to science, technology and society literacy

Yörük *et al* (2009) examined teaching students' course in relation with science, technology, society and environment, and the examination of its possible effects on students' achievement as well as their career choices. Scherz and Oren (2006) examined the images middle school students have of science and technology, the workplaces, and the relevant professions. It also describes the effect on these images caused by an instructional initiative, "Investigation into Science and Technology" (IST), designed to introduce students to science and technology in the "real life."
However in this study the researcher designed the *VM* in effect of STS over all she asked the participants to evaluate if the *VM* assured STS.

Chapter Three

This chapter covers four sections: (I) design of the study, (II) population and sample of the study, (III) data collection Instruments and data collection process, and (IIII) a description of the data analysis.

(I) Design of the study

This study investigated experts to examine their views on the development of the VM, and explored their views on the possibility of an initiative that would examine the role of the VM as a tool of science and technology literacy in informal Environment.
The research design followed the educational Research and Development (R& D) methodology outlined by Borg and Gall (1983).

(II) Population and sample

Population
Experts' participants in the study

- Science educators or pedagogical; who are experienced in academic work, instruction and learning theory.
- Subject matter experts; individuals in similar roles who have been or are currently working in the field of curriculum design, content analysis, teaches science for lower basic grades.
- Multimedia experts, individuals in similar roles who have been selected for long experience in programming design, developing virtual environments, and e-learning.
- Students of lower basic grades from (1-4).
- Parents of the lower basic grades students.

Sampling

Subsets of a non-parametric purposive sampling are chosen (Experts' participants, students and parents). According to Neuman (1994) purposive sampling is acceptable when an investigator seeks to identify specific cases for an in-depth study and when the researcher needs to locate unique cases that will be especially informative to the study.

Sampling Procedures

Experts' participants

- Science educators or pedagogical; have been selected for there experienced in academic work, instruction and learning theory.
- Subject matter experts; have been selected for their works in the field of curriculum design, content analysis, teaches science for lower basic grades.
- Multimedia experts have been selected for long experience in programming design, developing virtual environments and e-learning.

- Volunteer parents have been selected from the parents' of the lower basic students who volunteered.
- Students of lower basic grades from (1-4) have been selected from the schools accepted to participate with in March 2011.

Pilot study sample

A pilot study has been conducted to proof of concept for the *VM*, A purposive sample of the research study consisted of 10 subjects.

Formal Study sample

- A group of Experts' participated in the study is important to reflect the diversity of the experiences, academic qualification, and the professional role.
- A group of students from lower basic grades(1-4) in Jerusalem district, Bethlehem and Hebron participated in this study, diversity depend on previous achievement (weak, good, very good, and excellent) and on the grades from (1-4).
- A group of Volunteer Parents of the students whose diversity depended on academic qualification, their students' (previous achievement and the grades from (1-4)).

Formal study sample has participated in preliminary field test main field test *(User Evaluation) as will be descried later.*

The variables

Independent variables:

- Experience has three levels (less than four years, from four to seven years, more than seven years).
- Academic qualification includes three levels (B.A. degree, master degree and Ph.D.)
- Professional roles include two categories (school teachers, university teacher).
- Students' achievement has four levels (weak, good, very good, and excellent).
- Students' grades from first to fourth grade.
- Voluntary parent's qualifications include three levels (diploma, B.A, upper than B.A.)

The Dependent variable: the opinions of the experts about the VM to integrate technology with science in informal environment.

(III) **Data collection tools and data collection process**

The VM as a tool:

The research design of this study has followed the educational Research and Development (R& D) methodology outlined by Borg and Gall (1983; Gall, *et al,* 2003). As mentioned at the beginning of this chapter. The process of developing a *VM* through an R & D dissertation must be validated in a number of ways. Therefore, the requirements of each step of the R & D

process were followed carefully. This section outlines the seven-step development cycle which has been used in this study (see Figure 3.1). According to Borg and Gall the educational R & D methodology has its origins in industry where products are developed through a process that tests and refines products. Educational R & D products followed a process of field-testing, evaluation, and refinement of producing functional educational products and programs. The development of creating *VM* may be possible using the R & D process. The objective of the Research and Development process is to link educational research with educational practice.

The R & D process for developing of creating VM included the following steps:

1. Research and information collecting "Proof of concept".
2. Product planning and design.
3. Develop preliminary form of product.
4. Preliminary field testing.
5. Main product revision.
6. Main field testing.
7. Operational product revision
8. Operational field testing
9. Final product revision.
10. Dissemination and implementation (Borg and Gall, 1983).

The present research is a smaller scale study than intended by Borg and Gall, and therefore, revisions were made to the cycle for the purpose of this study, including omitting Steps 7, 8, and 10. These additional steps are not used in this study because of time and budget restraints inherent to graduate research.

As illustrated in Figure (3.1), the R & D process is not always linear. The process consists of a cycle where a product is created; it is possible that results of the preliminary field test or the main field test would require the researcher to return to an earlier step in the process. In this situation, the researcher would return to an earlier step in the process and then would follow subsequent steps until the product was validated.

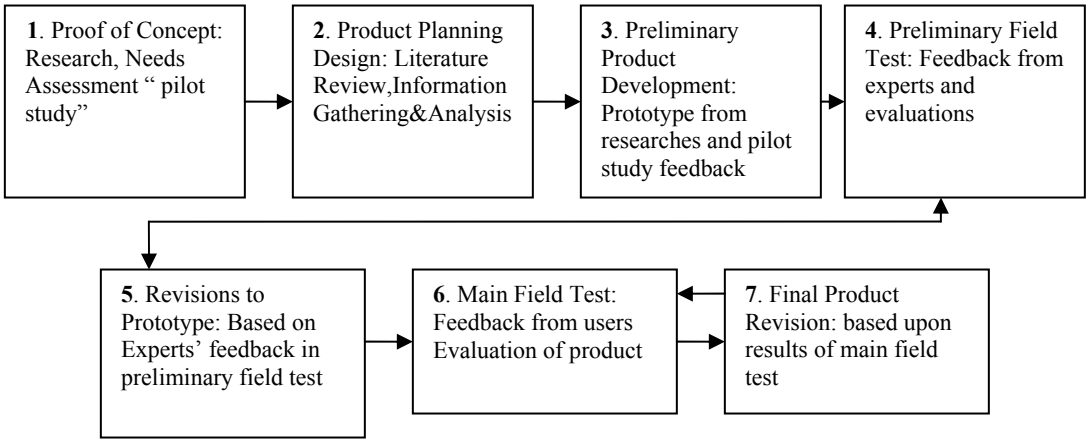

Figure 3.1 Models for the Seven-Step R&D Process.

The researcher regrouped the seven process of R&D model in the fallowing phases

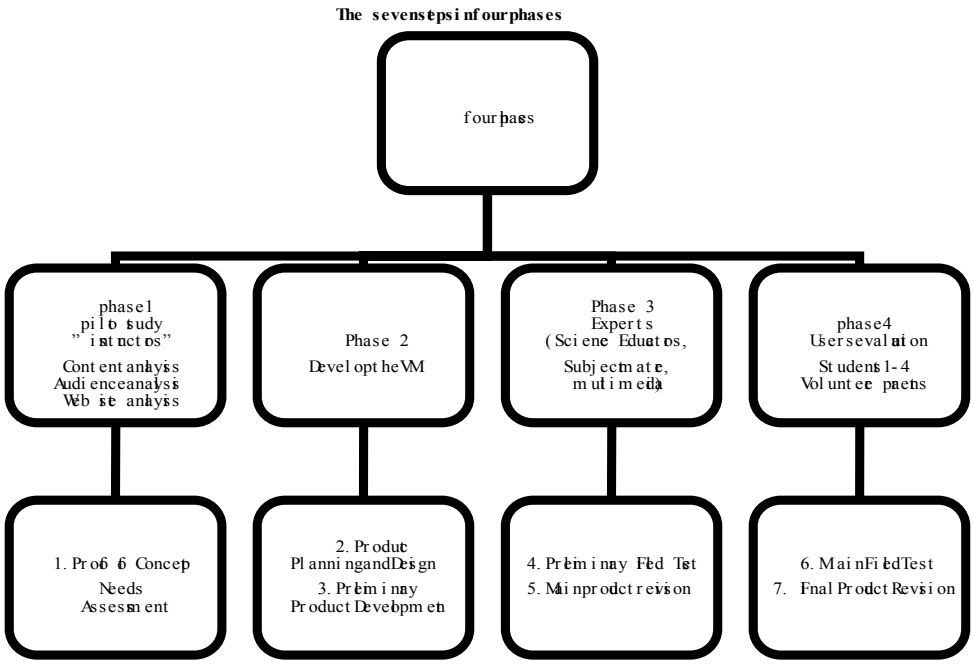

Figure 3.2 majors phases of the study

Table 3.1: Major events and timeline.

Phase	Event/Step	Timeline
Phase1	Review of the literature	February, 2010 – February, 2011
	Proof of concept	June, 2010
	Proposal approved by committee	14 August, 2010
Phase2	Development of the VM	August, 2010 –February, 2011
Phase3	Preliminary field test	15-February, 2011 – 1-March, 2011
	Revision of the product	March, 2011
Phase4	Main field test	15-March, 2011– 30-March, 2011
	Revision of the product	April, 2011
	Research presented to committee	23-July, 2011

Phase one: Contains the first process from R&D model which is:

1. **Research and information collecting (Proof of Concept)**

The proof of the concepts for the *VM* included the collection of information, through pilot study held in second semester of the academic year 2009\2010, interviews with subject mater

experts who were selected because of their experience in science teaching and curriculum development in Palestine(more than 5 years experience), through literature review. The proof of the *VM* concepts helped teachers and students need (the results of the pilot study coded and analyzed) to integrate science and technology in an informal environment in curriculum materials that incorporated primary sources and met curriculum standards.

The proof of the concept returned the following information: a) teachers and students had a need to use technology recourse (computer program) to engage in curriculum materials that incorporated primary sources and met curriculum standards; b) computer program shared in assured educational output; and c) the teacher proposed for benefit from the *VM* to design, internal of things. d) The concepts that the teacher needed to be computerized in informal teaching to support the formal teaching (from the pilot study results).

Pilot Study checklist

Since the researcher modified Alhusari's (2002) instrument (Appendix A.2) accommodated for the purpose of this study. The pilot study was sent to ten experts (science educators). It contained information about the participants (*Teacher specialization, Years of Experience*) and some questions related to using technology and open questions related to major concept in science needed to be computerized to bridge the gap between science and technology in informal learning; categorized in three themes: *Theme I:* aimed to identify teachers' opinions in the educational contributions of the computerized programs for the learner and the teacher as well as educational goals. *Theme II:* targeted to identify teachers' suggestions to design educational programs. *Theme III:* open-ended question was "Other suggestions you would like to add with regard to concepts that need to be computerized for linking science with technology in an informal learning environment?" The pilot study was accompanied with an interview to fill the major concept together. The pilot study translated. (See Appendix A.1)

Phase two: Contains two processes from R&D modified models mainly; 2. Product planning and design, 3. preliminary product development.

2. Product Planning and Design

The product planning and design process involved analyzing information gathered from the pilot study, and the reactions and feedback received from the concepts interviews. Science educators, subject matter experts, and multimedia experts were consulted during the planning and design of the *VM*. During this process, the target audience was specified to be multimedia interested in collaborating with community subject matter expert and science educators to create a *VM*. The *VM* did not exist in this area, learning materials developers of digital information in other technology-related areas were consulted during the planning and design of the VM.

3. Preliminary Product Development

A prototype of the *VM*; The design of the prototype based on the pilot study, feedback received from the pilot study, and the literature review. A model for developing a *VM* was

created from R&D adapted process that concluded the following Model listed in fig (3.3) to build the VM.

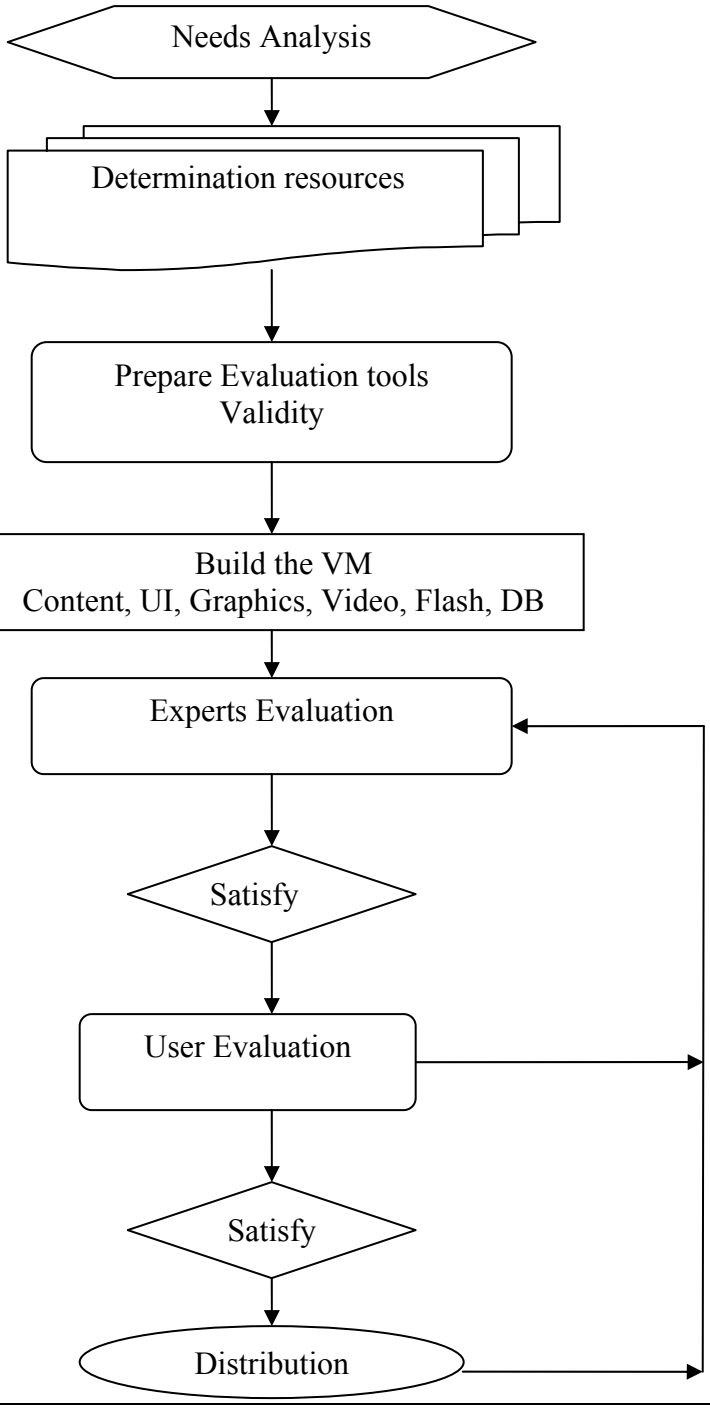

Fig 3.3: Model to Build the VM.

3.1. Needs analysis: Concepts which were the most agreed on by the participants in the pilot study were collected from the pilot study; (the state of water, lights, solar system, plants, grouping or classification). Science content from 1st to 4th grades, and more than five science

websites were reviewed. The collection and analysis of needs, which were related to the *VM*, in conjunction with the overall learning objective to be achieved, the needs of audience, and the context of learning "informal".

3.2. Determination: Determined resources content (science books and teacher guides for lower basic grade), software (Flash was Adobe flash, Data Base (DB) was Access, media player, User Interface UI designed slide design of the site interface, to enable the database-driven, dynamic generation of front-end pages and of media releases and job openings.

3.3. Prepare Evaluation tools: Through evaluation criteria; after reviewing the relevant literature and previous studies ((Geometry program evaluation checklist, n.d), (Morgado, 2007), (Alsumait, 2010) (Miller and Bach, 2001), Kids Evaluation Form, parents Evaluation Form, (Victoria, n.d), and **(**Woodley, 2000)), the researcher constructed three instruments, one for experts, one for parents, and one for children. See appendices (B.1,C.1, D.1).

3.3.1. Virtual Museum *VM* Experts' Evaluation Form:

This instrument is formed of three parts. The first one contained information about the experts (specialization, Experiences, level of higher education, Professional roles), and the second one contained criteria for *VM* evaluation form which consisted of 100 items divided into 14 domains:

Content & educational value: focus on the content, including the relevance, usefulness, and quality of the content of the *VM*,

Curriculum connections, national standards and objectives were clearly connected to target curriculum.

Graphics/ Multimedia, Lay-out, Technical Aspects, Adaptability/ Accessibility, Engagement/ Interactivity, focus on the format of the *VM*, which included readability, sequence, and organization of the *VM*. These parts address usability and readability of the *VM*, navigate and understand.

Teacher & learner support materials, Assessment methods, Age/Grade Appropriateness, Flexibility; these parts address applicable material for such audience in the class or at home.

Integrating the technology lab into everyday life, Computer Skills, "Science-Technology-Society" STS, these parts evaluated whether the *VM* characterized by STS, or included science and technology literacy through informal Environment.

Finally, some open questions provided the field testers with the opportunity to make specific comments about suggestions for revising the *VM*'s content and usability. The major strengths, the major weaknesses, overall quality of these instructional materials, as informal environment could successfully affect the class of science and technology, comments overall checklist. (See Appendix B.2)
The instrument was translated into Arabic; two judgment translators agreed on 87% translated items. (See Appendix B.4)

Two judgment translators translated the instrument. Translation reliability was manipulated through the degree of agreement between both of them.

3.3.2. Virtual Museum *VM* parents' Evaluation Form:

This instrument consisted of three parts, the first one contained information about the parents qualifications (lower than two-year diploma, B.A, Diploma, upper than B.A, Others), and child's grade, child achievement, and the second one contained criteria related to the *VM* evaluation form which consisted of 70 items divided into nine domain: General Software Quality Evaluation, Operational Problems, Appearance, Navigation, Content, Enjoyable, Parent Friendliness Truth in packaging items, Integrating the Technology lab into everyday life, Computer skills, STS programmed characterized, the third one open comments. (See Appendix C.1)
The instrument was translated into Arabic, two judgment translators agreed on 90% of the translated items. (See Appendix C.3)

3.3.3. Virtual Museum *VM* Children' Evaluation Form:

This instrument consisted of three parts, the first one contained information about the children grade and achievement. The second one contained criteria related to the *VM* evaluation form which consisted of 60 items divided into nine domains: General Software Quality, Operational Problems, Appearance, Navigation, Content, Enjoyable, Integrating the Technology lab into everyday life, Computer skills, STS programmed characterized, the third one is open comments. (See Appendix D.1)

The instrument was translated into Arabic, two judgment translators agreed on 92% of the translated items. Appendix (D.2)

3.3.4 Focus group interview:

After finishing evaluation the VM, half-hour focus group interview was conducted to elicit these students' in-depth perceptions towards the use of the VM. Ten participants were selected for the interview, as those students were more willing to share their feelings, relied primarily in the analysis of the virtual museum for this study. The interviews concluded at the latest possible time during the visits to the school after evaluation the VM, so that the participants would have the most time to experience the project activities and formed their opinions about them. The interviews were conducted in an informal manner, with two or three participants at a time, initial research questions were used as a guide to help keep track of the topics that were addressed in the interview, as the study progressed, and it developed a more focused questioning strategy.

Validity of the instruments:

As a content validity measure, it was offered to a number of qualified experts (See Appendix E) who provided an insight regarding the draft questionnaires and the evaluation form questions. The goal was to determine if the questions from the item pool were clustered

appropriately by their content and clearly written, their suggestion refined the instruments, after confirmation of the validity of the instruments which were used.

3.4. Build the VM: The translation of the requirements into concrete design specifications, featuring: Start in designing home experiments, computerized experiments, worksheet, content, layout, graphics, video, DB which contained all the resources and, it could be expanded to contain another concept with various activities.
The museum has many sections (objective, computerized experiments, home experiments, fact history of science, technology of science, games, useful link, and Audio-visual tools (like short films) complete this innovative Virtual Museum (see appendix M.1).

3.4.1 The Virtual Museum structures' in designing the museum building, the researcher have a number of ideas in mind. Firstly, she wanted a central connecting area which could act as an entry point to all the rooms in the museum. This manifested itself as an atrium which was also the entrance and exit of the museum. Secondly, the researcher wanted to create an interesting space. Early experiments with page layout of room led to other rooms feel to the museum. Because of this, it was decided to create a museum with a rectangle structure. As models standing on the floor, with small portions "doors" of the rectangle space are revealed at each turn, tempting the viewer to explore further. The researcher created a database of multimedia that included objects in the areas of plants, light, solar system and water. Within each of the rooms were exhibits, which consisted of either Links to interactive flash, video, games document with educational object, experiment at home, technology of science, history, facts, and evaluation, which emphasized the content to be scientific, related to curriculum, creative, authentic, and easy to understand. (See Appendix F.1, M.1)

3.5. Experts Evaluation: creation and verification/ validation of the VM through the three Experts (multimedia, subject matter, pedagogical), if the experts are satisfied, then the builder has to go to the next step, if not, he has to return to the previous step to do the maintenance. This is equivalent to preliminary field test.

3.6. User Evaluation: if the user is satisfied, then the builder has to go to the next step, if not, he has to return to the previous step to do the maintenance. This is equivalent to User Field Test.

3.7. Distribution: if the VM is satisfying through analysis the results, distribute it to participants.

Phase three: Contains two processes from R&D models which are: 4.Preliminary field test, 5. main product revision

4. Preliminary Field Test "*Expert Evaluation*"

The purpose of experts' evaluation was to obtain an initial qualitative evaluation of the prototype validity. The *VM* prototype was evaluated through a preliminary field test. 18 experts were asked to complete an instrument of evaluation to review and evaluate the prototype. The sample conducted in 5 to 15 school using 6 to 12 subjects. Interview, observational and questionnaire data collected and analyzed (Borg and Gall, 1983, p775).

Each expert was given a copy of the *VM*, a letter of instruction, and an instrument of evaluation. Experts were asked to determine the product's general quality by rating the *VM* on an instrument of evaluation and providing feedback comments to modify the product. The instrument of evaluation contains fourteen domains as described above.

Expert's participants in this step

- Science educators or pedagogical; who have experienced in academic work, instruction and learning theory.
- Subject matter experts; individuals in similar roles who have been or are currently researching or working in the field of curriculum design and content analysis.
- Multimedia experts, individuals in similar roles who have been selected for long experience in programming design and developing virtual environments and e-learning.

Participants (Subject matter experts, science educators or pedagogical, multi media experts), were selected from three different, and specific populations. It is important to have participants who reflect the diversity of the profession with known or demonstrable experience and expertise in the area (Torchim, 1999). This was primary concern to the researcher because the intent of the study was to examine what these experts' opinions about the creation of the *VM* as a tool of science and technology literacy in an informal environment, and through whom suggestions were provided to develop the *VM***.**

5. Main product revision

Revisions of the *VM* prototype was based on the data collected from the preliminary field test; the comments by the experts were seriously regarded and incorporated into the revision.

Phase four: Contains two processes from R&D models: 6. Main Field Test *(User Evaluation)* and 7. Final Product Revision

6. Main Field Test *(User Evaluation)*

A main field test was completed by using pilot study from lower Basic grades (1-4), science educators, and volunteer parents. The *main field test* purpose was to obtain additional information on the usability and usefulness of the *VM*. The students who have participated in the main field test have used the test version of the *VM*, the researcher provided them with a set of instructions to know how to utilize the program, and she was monitored them; for any clarification; when they complete the instrument that served as the main evaluation tool. The sample conducted in 5 to 15 schools with 30 to 100 subjects. Interview, observational and questionnaire data collected and analyzed (Borg and Gall, 1983, p775).

User's participants in this step

- Students from lower basic grades (1-4) from five schools, each school 20 with 5 from each class participated in this study, they were randomly selected
- A group of Volunteer Parents of the students.

The best product designs result when the product's designers are involved in collecting and interpreting users data and appreciate what real people need (Beyer & Holtzblatt, 1999). The purposes of the user evaluation to: (a) measure the usability/practicality of the prototype, (b) identify users' needs, (c) identify strengths and weaknesses in the *VM* as well as ways to improve them, and (d) use the results of this evaluation to revise the prototype.

7. Final Product Revision

Final revision of the *VM* was based upon the results of the main field test. The recommendations were made by the product's targeted group, analyzed and considered as formative and summative evaluation of the *VM*.

The results of the study included the final version of the *VM.* This version is to be provided to each of the proof of concept experts, the preliminary field test leaders and the main field test reviewers.

Data collection process:

The goal of *the thesis is* to develop virtual museum from the perspective of the participants for lower Basic grades as a tool of science and technology literacy in informal environment.

1. Develop the evaluation instruments
2. Develop the *VM*
3. Two judgment translators translated the instrument. Translation reliability was manipulated through the degree of agreement between the two translators.
4. Browse the VM to 18 experts. Each expert was given a copy of the *VM*, a letter of instruction, and the instrument of evaluation (see Appendix B.1, B2, B3, B4). Experts were asked to determine the *VM's* general quality by rating the *VM* with the instrument and providing feedback comments. Any expert's responses that were unclear to the researcher were clarified through follow up methods such as email and telephone. These data were used to determine the strengths and weaknesses of the *VM*. On the Yes/No scale, a means rating over 1.5 was considered as "satisfactory" and below 1.5 was considered as "unsatisfactory", and over 70% was considered as a satisfied domain.
5. Update the *VM* according to experts' evaluation.
6. Browse the VM to 12 parents. Each parent was given a copy of the *VM*, a letter of instruction (see Appendix C.1), and the parents' instrument of evaluation (see Appendix, C.2, C.3). The parents were asked to determine the *VM's* general quality by rating the *VM* with the instrument and providing feedback comments. These data were used to determine the strengths and weaknesses of the *VM*. On the Yes/No scale a means rating over 1.5 was considered as "satisfactory" and below 1.5 was considered as "unsatisfactory", and over 70% was considered as a satisfied domain.
7. The documents of 5 schools to participate in evaluating the VM were taken from the deanship of education in Al Quds University (See Appendix L).
8. The researcher and technology teachers installed the program in school laboratories.
9. 100 subjects from 5 schools were applied in the Evaluation of the VM. The children were asked to act as experts and evaluate the system on a voluntarily basis, using a

simplified instrument of evaluation, each child was given a copy of the *VM*, a letter of instruction, and the instrument of evaluation (See Appendix D.1, D.2). Children were asked to determine the *VM*'s general quality by rating the *VM* with the instrument and providing feedback comments. These data were used to determine the strengths and weaknesses of the *VM*. On the Yes/No scale a means rating over 1.5 was considered as "satisfactory" and below 1.5 was considered as "unsatisfactory", and over 70% was considered as a satisfied domain.

10. Third and fourth grades students browsed the VM to complete the *instruments of evaluation*; first and second grades browsed the VM; the researcher and the teachers helped him to complete the instrument of evaluation.
11. Reviewed collected forms.
12. Hold the focus interview with student.
13. Analyzed the data.

(IV) A description of the data analysis.

Chi square test of homogeneity was used to provide statistical analysis of collected data and to identify significant difference (*p* value) between user categories.
Data was contained both qualitative and quantitative data. The qualitative data was analyzed with reading, grouping and regrouping. The quantitative data was analyzed using the SPSS© quantitative statistical software program.

Descriptive statistics were used to generate experts' information and to summarize participant responses through, means, frequency distribution and percentage calculations base on the *evaluation* instruments.

Nonparametric Kruskal Wallis Test used to examine the relationship between the dependent and independent variables for statistically significant differences. Dependent variables include the summary of all instruments. Independent variables consisted of each response from the expert type, qualification, experience, and professional roles, students' grade and achievement, and volunteer parents' qualifications. All the sums of questions within each dependent variable were compared to each background variables.

The open ended questions were coded and analyzed using a coding scheme, the data analysis will be followed the six steps that Creswell recommends in data analysis and interpretation, "the generic steps involve the following steps:

1. Organize and prepare the data for analysis.
2. Read through all the data.
3. Begin detailed analysis with a coding process. (The researcher regrouped the comments the same as the domains of instrument)
4. Use the coding process to generate a description of the setting or people as well as categories or themes for analysis.
5. Advance how the description and themes will be represented in the qualitative narrative.
6. A final step in data analysis involves making an interpretation or meaning of the data. (Creswell, 2003)

Chapter Four

4.1 Preliminary field test results and discussion

This chapter contains the findings and discussion; preliminary field test instrument domains, the open ended questions, action taken by the researcher, and revisions to prototype.

The creation of the virtual science museum exhibition is a process that is not completed with just the creating of the *VM*, but must also incorporate feedback from the experts who refine the *VM*. The evaluation form was designed to collect data that would identify the strengths and weaknesses of the museum in terms of museum design, *content and educational value, curriculum connections, graphics/ multimedia, lay-out, technical Aspects, adaptability/ accessibility, engagement/ interactivity, teacher & learner support materials, assessment methods, age/grade appropriateness, flexibility, integrating the technology lab into everyday, computer skill's, STS programmed characterized, open ended questions, over all evaluation form.*

Each expert was given a copy of the *VM*, a letter of instruction, and the instrument of evaluation (See Appendix B.1, B.2, B.3, B.4). Experts were asked to determine the *VM's* general quality by rating the *VM* with the instrument and providing feedback comments. Any expert responses that were unclear to the researcher were clarified through follow up methods such as email and telephone. These data were used to determine the strengths and weaknesses of the *VM*. On the Yes/No scale a mean rating over 1.5 was considered "satisfactory" and anything below was considered "unsatisfactory", and over 70% percentage considered a satisfied domain.

The following question guided this study:

I. Could the three experts (Pedagogical, Subject matter, and Multimedia) cooperate effectively to create a virtual museum which promotes science and technology in learning? This question was answered through the following sub-questions:

Q.1. What are the opinions of the experts about the *VM*?
The findings related to the first question of the preliminary field test are demonstrated by mean and percentages as described in table (4.1)

Table 4.1: Number of experts, means, and percentage of expert opinions for each domain

	Domains	No. of experts		Mean	Percentages opinion	
No		Valid	Missing		% No	% Yes
1	Content & Educational Value	18	0	1.933	14.30	85.70
2	Curriculum Connections	16	2	1.829	14.00	86.00
3	Graphics/ Multimedia	18	0	1.924	08.57	74.77
4	Lay-out	17	1	1.941	05.90	94.12
5	Technical Aspects	18	0	1.925	09.44	90.66
6	Adaptability/ Accessibility	16	2	1.887	14.70	84.12
7	Engagement/ Interactivity	17	1	1.929	14.08	85.95
8	Teacher & Learner Support Materials	18	0	1.791	20.77	79.18
9	Assessment methods	18	0	1.875	13.00	87.00
10	Age/Grade Appropriateness	18	0	1.963	05.68	96.22
11	Flexibility	18	0	1.861	15.45	84.55
12	Integrating the Technology lab into everyday	18	0	1.925	07.67	92.86
13	Computer skill's	17	1	1.841	15.88	84.13
14	STS programmed characterized	18	0	1.797	20.99	79.02
	Over all evaluation form	18	0	1.835	15.72	86.06

The results in Table (4.1) show that the STS programmed characterized was the domain with least satisfaction with a mean of 1.797. 79.02% of the experts found that the *VM* assured *STS*, while 20.99% found it wasn't. *Age/grade appropriateness* was the domain with the highest satisfaction with a mean of 1.963. 96.22% of the experts found that the *VM* appropriation. None of the domains have an unsatisfying rating; all of them have a mean greater than 1.5 and more than 70.00%.

Out of 18 experts surveyed, 85.70% found *content and educational value* suitable while 14.30% found it unsuitable. 86.00% of the experts found that there was *curriculum connections* while 14.00% found there weren't. 74.77% of the experts found that *graphics/ multimedia* was suitable while 8.57% found it wasn't. 94.12% of the experts had found that the *lay-out* was suitable while 5.90% found that it wasn't. The results show that 90.66% of the experts found that the *technical aspects* was suitable while 09.44% found it wasn't. 85.95 % of the experts found that the *adaptability/ accessibility* was suitable while 14.08% found it wasn't. 85.95% of the experts found that the *engagement/ interactivity* was suitable while 14.08% found there wasn't. 79.18% of the experts found that the *VM* is satisfactory as *teacher & learner support materials*, while 20.77% found the *VM* wasn't satisfactory. 87.00% of the experts found that the *assessment method* was appropriate while 13.00% found it wasn't. About the *flexibility* domain 84.55% from the experts found it was flexible and 15.45% found it wasn't. About *integrating the technology lab into everyday* 92.86% from the experts found the VM appropriated to integrate the technology lab into everyday, while 07.67% found it wasn't. 84.13% found the *VM* helped the children achieved *computer skill's* domain, while 15.88% found it wasn't. 86.06% from the experts satisfied the *over all evaluation form*, while 15.72% unsatisfied.

The experts have positive opinions toward the *VM* since the satisfactory domains were all greater than 70%. The domain with least satisfaction was *STS programmed characterized* since 79.02% of the experts found that the *VM* assured *STS*. Moreover, *age/grade appropriateness* was the highest satisfaction with a percentage of 96.22%.

The preliminary field test yielded positive feedback from experts regarding the *VM's* instrument evaluation for revision domains. The *age/grade* was the domain with highest satisfaction since the material was collected with reference to the pilot study to determine needs of the audience, from which the researcher has taken the results as her priority. In the *STS* domain which was the least satisfactory, there are a couple of unsatisfactory items: "Identify local real life problems" (55.60%) and "Adopt decision-making roles" (58.80%). (See Appendix G)

Since the standards seem to have determined the researcher to some extent of their inspiration, and certainly of their liberty to develop content, while they must develop content particularly to meet standards. The designers must be mindful to match the content of their simulation to existing educational standards. In this case, the educational standards seem to have robbed the software designers to some extent of their creativity, since educational standards reduce not only teachers' ability to meet the specific needs of their students but also designers' ability to innovate and produce products that are relevant to particular target audiences (Fleischmann's, 2007). For that reason, the *STS* domains the least unsatisfied domain, the researcher agreed that more attention can be paid to *STS* and recommended possibilities for extending the design of the *VM* to increase *STS* domain satisfaction. Fleischmann's (2007) claim that "science and technology standards have a strong influence on the use of educational simulation software in biology classes, and this influence may be growing". Further suggestions for improvement through the open ended comments will be discussed later in this chapter.

The results of the preliminary field test agreed with Phipps' (2008) result that "this exhibit is well loved", but disagreed with the difficulty to understand for visitors and docents alike. He agreed that the exhibit needs some revision if it is to become more accessible to more visitors.

Q.2. Is there any significant difference in experts opinions related to expert type (Pedagogical, Subject matter, and Multimedia)?
To answer this question the researcher has utilized the nonparametric Kruskal Wallis Test.

Table 4.2: Kruskal Wallis Test, grouping variable: expert

Domains	Chi-Square*	Asymp. Sig.
Content & Educational Value	0.318	0.853
Curriculum Connections	10.188	0.006
Graphics/ Multimedia	6.474	0.039
Lay-out	3.760	0.153
Technical Aspects	1.486	0.476
Adaptability/ Accessibility	4.607	0.100
Engagement/ Interactivity	3.290	0.193
Teacher & Learner Support Materials	6.615	0.037
Assessment methods	0.617	0.734
Age/Grade Appropriateness	4.250	0.119
Flexibility	0.958	0.620
Integrating the Technology lab into everyday	0.117	0.943
Computer skill's	4.582	0.101
STS programmed characterized	3.988	0.136
Over all evaluation form *df=2	4.819	0.090

The results in table (4.2) show that significance levels over 0.05 indicate that the various experts (Pedagogical, Subject matter Expert, Multimedia Expert) have similar opinions toward the VM.
It is seen that the similarity in experts' opinions toward the VM agrees with the results of the open question: "In your opinion, what are the major strengths of this program?" The responses assured that the experts have similar opinions toward the VM in relation to the three experts' types all having mentioned that it is as an interactive program. Some of the other experts noted that it provides additional activities and links to external websites.
The experts have been selected based on their experience in e-learning so they have the same experience in this domain. The pedagogical and subject matter experts have background in computer science besides the education programming, while the multimedia experts have background in education programming besides the computer science. Due to these characteristic they were similar in there opinions.

Q.3. Is there any significant difference in experts' opinions related to academic qualifications (B.A., MA., Ph.D.)?

To answer this question the researcher has utilized the nonparametric Kruskal Wallis Test.

Table 4.3: Kruskal Wallis Test, grouping variable: Academic qualification, subject expert

Domains	Chi-Square*	Asymp. Sig.
Content & Educational Value	5.213	0.074
Curriculum Connections	0.399	0.819
Graphics/ Multimedia	1.152	0.562
Lay-out	4.829	0.089
Technical Aspects	0.668	0.716
Adaptability/ Accessibility	5.560	0.062
Engagement/ Interactivity	4.713	0.095
Teacher & Learner Support Materials	6.286	0.043
Assessment methods	2.471	0.291
Age/Grade Appropriateness	3.261	0.196
Flexibility	1.354	0.508
Integrating the Technology lab into everyday	0.243	0.886
Computer skill's	4.908	0.086
STS* programmed characterized	3.218	0.200
Over all evaluation form *df=2	4.379	0.112

The results in table (4.3) show that significance levels over 0.05 indicate that the experts are similar in their opinion toward the VM in relation to academic qualifications (B.A. degree, MA. degree, Ph.D. degree).

Some responses to the open question, "In your opinion, what are the major strengths of this program?" assured that the experts were similar in their opinions toward the VM according to academic qualifications; three experts (Ph.D. degree, MA. degree, BA. degree) see that it is suitable for many learning style and "Allow to read, write, watch, and hear". All academic

qualifications desired the technology in information age and they were looking for more and more for computerization of the educational system.

Q.4. Is there any significant difference in experts' opinions related to experience level (less than four years, from four to seven years, more than seven years)?
To answer this question the researcher has utilized the nonparametric Kruskal Wallis Test.

Table 4.4: Kruskal Wallis Test, grouping variable: Expert Level, subject = experts

Domains	Chi-Square*	Asymp. Sig.
Content & Educational Value	3.009	0.222
Curriculum Connections	3.254	0.197
Graphics/ Multimedia	2.057	0.357
Lay-out	2.778	0.249
Technical Aspects	4.057	0.132
Adaptability/ Accessibility	0.491	0.782
Engagement/ Interactivity	2.105	0.349
Teacher & Learner Support Materials	0.543	0.762
Assessment methods	1.155	0.561
Age/Grade Appropriateness	1.658	0.436
Flexibility	3.676	0.159
Integrating the Technology lab into everyday	0.463	0.793
Computer skill's	0.852	0.653
STS programmed characterized	1.166	0.558
Over all evaluation form *df=2	0.004	0.998

The findings in table (4.4) show that Significance levels over 0.05 indicate that the experts are similar in their opinions toward the *VM* according to experience level (less than four years, from four to seven years, more than seven years). The responses to the open question "In your opinion, what are the major strengths of this program?" assured that the expert were similar in their opinions toward *VM* evaluation in relation to experience level; Three experts, one from each of the experience categories said that the major strength of the *VM* was the use of graphics and colors to represent information, and that this draws the attention of students. The experience level didn't affect the experts' opinions; all of them appreciated the need of such programs in the educational system. It is usually assumed that the lowest level of experience may have a more positive opinion than highest level toward technology considering they are younger in age. However, in this study the level of experience didn't affect the opinions.

Q.5. Is there any significant difference in experts' opinions related to professional roles (school teacher, university teacher)?

To answer this question the researcher demonstrated Kruskal Wallis test as describe in table (4.5)

Table 4.5: Kruskal Wallis test, grouping variable: professional roles, subject = experts

Domains	Chi-Square*	Asymp. Sig.
Content & Educational Value	.748	.387
Curriculum Connections	.205	.651
Graphics/ Multimedia	.010	.922
Lay-out	1.234	.267
Technical Aspects	.259	.611
Adaptability/ Accessibility	3.160	.075
Engagement/ Interactivity	4.577	.032
Teacher & Learner Support Materials	4.946	.026
Assessment methods	.041	.840
Age/Grade Appropriateness	.744	.388
Flexibility	.154	.694
Integrating the Technology lab into everyday	.071	.791
Computer skill's	2.746	.097
STS* programmed characterized	.406	.524
Over all evaluation form *df=1	.955	.328

The results in table (4.5) show that Significance levels over 0.05 indicate that the experts similar in their opinions toward the *VM* evaluation in relation to professional roles (school teacher, university teacher).

The professional roles didn't affect the experts opinions; all of the academic institutions work to support and increase employee technology qualifications in the information age. As a result employees have more or less the same experience in technology and look forward to computerizing education.

The responses to the open question "In your opinion, what are the major strengths of this program?" assured that the experts didn't differ in their opinions toward *VM* evaluation in relation to professional roles.

Two experts "university teacher, school teacher" noted that the *VM* was easy to use. And it was easy to deal with in terms of exit and entry of Events.

The open ended questions:

To answer the open ended questions the researcher grouped the comments of the experts, see their name in Appendix (H.1). Specific comments from the preliminary field test for each of the format related items are listed in table; any action taken based on the expert's comments was described in the *research actions* column of the table shown in appendix (H.2).

The researcher actions were categorized according to four identifiers:

agreed, the research agreed with the suggested change by the expert and made a corresponding change to the VM; *disagreed*, the researcher disagreed with a suggested change by the expert and indicated the reasoning for not making a change to the VM; *acknowledged*, the researcher acknowledged a comment and any changes to the VM based on this comment were described; and *agreed for future step* the researcher hopes to do in the future, may be

with team, see Appendix (H.2) for experts' comments in details as their world, here is the summary.

The results and discussion of the first two open ended questions which answers the research question number 6. "What are the possible deficiencies or strengths of the *VM*?" Responses to the following open questions in the evaluation forms were collected.
First: In your opinion, what are the major strengths of this program?
Second: In your opinion, what are the major weaknesses of this program?

As for the first question, the researcher collected responses and acknowledged the following comments:
Some of the multimedia and subject matter experts (4) saw that the major strengths of this program are exceptional in terms of introducing e-learning to this level. It also encouraged the children to study and gave them an unusual way to learn. Other multimedia and subject matter experts (3) noted that a lot of effort was made on collecting materials in Arabic. This comment was *acknowledged* by the researcher for appreciating the work of over more than one year collecting, grouping, and programming the material to be appropriate to such sensitive group of audience.

Other multimedia, subject matter and pedagogical experts (3) mentioned that it was an interactive program. This was also *acknowledged* because one of the major objectives was to create an interactive program. Other multimedia, subject matter, pedagogical experts (4) noted that it provides additional activities and links to external websites. This comment was assured; it is important to train the audience to utilize websites for improving their education. Other multimedia, subject matter (3) saw that it is suitable for many learning styles providing them with opportunities for reading, writing, watching, and listening hoping that it will be tested in an empirical way to assure suitability. The researcher *acknowledged* this response. Other multimedia and subject matter experts (4) noted that the major strengths were the content and evaluation forms; the scientific material (content) is familiar to students. Others noted that the VM was easy to use, and it was easy to deal with in terms of exit and entry of events. Other subject matter experts (3) said that the major strength of the *VM* was the use of graphics and colors to represent information which draws the attention of students. Two experts' multimedia, subject matter noted that the major strength of this program is that it builds some skills and thinking for the users of this system and gives them the opportunity to cooperate with each other. It gives the child the opportunity to develop openness to knowledge and discovery, curiosity and develop scientific thinking skills. The researcher assured the comment that the *VM* achieved this wide objective in scientific education; which is the measurement of development in science. A multimedia expert noted that the *VM* addressed matters of science, technology and society, in addition to other areas of cognition. This comment assured one of the major objectives of this *VM*.

In response to the second question, "In your opinion, what are the major weaknesses of this program?" there was disagreement among the experts about the weaknesses. So the researcher *agreed* with some points as weaknesses of this program, and *disagreed* with others. For example, one of the experts (multimedia, Ph.D. degree, more than seven years experience, university teacher) noted that a weakness of the *VM* was the inability to keep the content timely and current. The researcher *disagreed* because the *VM* database has the ability to keep

the content timely and current with add, delete, and update records options; however, it is better to have it as website. Another expert (multimedia, Ph.D. degree, more than seven years experience, university teacher) said that it's very limited for some subjects. The researcher *disagreed* because she had taken five concepts in depth and interdisciplinary with other subjects; the idea is flexible to be extended to other concepts and subjects. Moreover, one of the experts (multimedia, Ph.D. degree, more than seven years experience, university teacher) said that the wide range of the target group ages is expected to require different considerations and content in the suggested program. The researcher *disagreed* with these points as weaknesses of this program because she had taken this point as a priority for different considerations, different content and different levels from first grade to fourth grade. One of the experts (Subject mater, BA. degree, more than seven years experience, school teacher) said some information is beyond the level of the student; for example, the names of some animals in English which the student didn't learn. The researcher *disagreed*; let them learn information that is beyond their level.

The researcher *agreed* with the experts recommended notes; one of them (multimedia, Ph.D. degree, more than seven years experience, university teacher) said "there should be more virtual labs". This was taken into consideration and more virtual labs were added. Another multimedia expert said that the materials provided for evaluating higher skills are limited. Another pedagogical (Ph.D. degree, more than seven year's experience, university teacher) said that "more animation is needed for some of the contents". This was also taken into consideration and more animation was added. Another multimedia noted there is a need to develop the child's ability in creative thinking and production of new knowledge. Another pedagogical expert noted a need for more activity that encourages higher level of thinking and more social interaction, develop the child's ability to creative thinking and production of new knowledge. The researcher *agreed for future steps*. This has been as recommendation.

Concerning the third open question which responds the seventh research question "In your opinion, what is the overall quality of these instructional materials?" The researcher acknowledged the following experts' notes, one of them multimedia expert recommended it as an outstanding attempt to change the way of presented science to our children. Another multimedia said that it helps users of self learning and self dependent. One of them multimedia (Ph.D. degree, more than seven years experience, university teacher) said that "over all quality from multimedia view point is good". Another one multimedia appreciated the comprehensive use of teaching and learning technologies as an effective and attractive presentation of the elementary grades curriculum. Another two subject matter experts said that could accustom the student to study using computer, excellent work.

Concerning the fourth open question which answers the eighth research question: Could the *VM* as informal tool play roll in science and technology literacy of lower basic grades? Responses to the following open question in the evaluation forms were collected. "In your opinion, as informal environment could be successful affect of the class science and technology?" The researcher need more details from the expert in this question may be the form of the question was limited the answer, so, three experts' multimedia, subject matter, pedagogical said that yes it could be. Another pedagogical, said yes and he expected that it will affect the teaching science and technology. Another pedagogical said that it could effect successful and in a big form. There were two detailed answer one of them related pedagogical

(Ph.D. degree, more than seven year's experience, university teacher) said: the useful links to other museums and educational resources could be as source for linking class in informal environment. Another pedagogical (Ph.D. degree, more than seven years experience, university teacher) said: yes, by providing further interactions between student and the concepts throw different meaningful and enjoyable situations, the researcher *agreed* with him. The last one subject matter (BA. degree, more than seven years experience, school teacher) said: no, the researcher had telephone him to clarify his reason to say no, he said that the VM couldn't be as informal environment like the real one. The researcher respects his opinion.

The responses of the experts provided a potentially acceptable way for Informal Science Education to help children engage in meaningful learning experiences that are also enjoyable. This agreed with Maher and Corbit (2002) result related to gaming technology and thus attractive to youth, virtual environments can be applied to formal and informal science education in areas such as genetics, as well as to language learning and social studies. As Frensh (2007) finding to visitor attitudes were generally positive toward learning in informal settings and space science as it was presented in the exhibit. Like as Kralina (2009) Articulating a theoretical framework to valid the power of informal learning structures may help other educators to understand the potential benefits of science Extra Curricular Activities (ECA) and thus, increase opportunities for such experiential activities in order to enhance engagement and expand positioning of their students in science. More engaging, socially constructive science ECA has the potential to enhance science education.

Concerning the instrument of evaluation overall comments; all experts included additional comments on the *VM* environment. The over all comments results were regrouped as the instrument of evaluation domains as shown in Appendix (H.2):

Content & educational value: four of the experts; two pedagogical, another two subjects matter indicated that the content is presented fairly logically, clearly, appropriately and simply. The researcher *acknowledged* these notes.

Graphics/Multimedia: the researcher *acknowledged*: three multimedia experts who found the text in the *VM* easy to read and it is clear and concise, the graphics appropriate, another pedagogical expert found the text in the *VM* easy to read and it is clear and concise, saying: "I do not have comments other than keep up the Good work when you make changes!" The researcher *agreed* with multimedia expert recommended that the sound should be introduced not just labels for headings. The child should hear "Animals" for example not just read the label "Animals"; the researcher *agreed;* this was taken into consideration and more voice was added. This result agreed with Laghos (2010) it was noted that some more characteristic sounds could have been used as feedback on correct and incorrect answers in addition to sounds being used when buttons or images were clicked.

Another two pedagogical, multimedia said: more multimedia design of the front page; with website the front page will be more attractive; the researcher agreed with profound hoping to lance the VM as website. The researcher *agreed* with another pedagogical recommended that it should be better to mention more colors in the user interface screen to be more interactive. This was taken into consideration and more colors were added to the user interface screen. Another multimedia expert noted that the *VM* is too classic for children; some pictures

required, and he recommended a new technology (real life) that could have been used to enter a real museum virtually and do all these activities. The researcher *agreed* with him and she found a lot of website which provided the opportunity to do virtual real lab, but the researcher need permission to log to such website, overall the virtual reality need special hardware which wasn't available for the researcher, and there is language such as *VRML Virtual Reality Markup Language* specially for this purpose, these need team to work together, and need funded for such project. This individual work is a sample for future idea.

Technical aspects: two of the experts' one of them multimedia expert the other pedagogical thought that the browse page is a limitation of the VM, where some of these components would work better as sidebars online. The researcher *agreed* that the browse page format is limiting hoping that the VM will eventually be available in an online website. Two experts strongly recommended for improving the VM website, not the VM software. For the purposes of this thesis there will not be an online version, and the researcher would like to see an online version of the VM implemented in near future.

Engagement/ Interactivity: One of the experts (multimedia, Ph.D. degree, MA. degree, more than seven years experience, university teacher) recommended having more games for this age the researcher *agreed* one game was added which is "classification the animals" appendix (M.2).

Assessment methods: There were three types of comments:
First: few of multimedia experts (4) noted that there was no overall evaluation for exercises, for example, one of them (multimedia, Ph.D. degree, more than seven years experience, university teacher) noted that "This is an excellent tool for children to access information and self-assessment, there is no problem-solving assessment that the teacher look at what the student did at home and interact with that student, in this case the parents have to sit with their children for external assessment or this is done in class where the teacher has to follow each student. But this is not the reason why this project is done, the student may learn at home by games and movies,… in this case the VM does not provide teacher assessment… it is just self assessment". The researcher *agreed for future step*; it is an excellent feature that is available on the future.
Second: three subject matter experts declared that the worksheets was fun, and it would be better if there have be more of them. This was taken into consideration and more worksheets were added. Appendix (M.3)
Third: one of the multimedia experts (Ph.D. degree, more than seven years experience, university teacher) noted that "most evaluation is related to information, not skills". The researcher *agreed for future steps*; it will take into consideration in the near future.

In a few words reviewed how this research has led to insights that may inform future work in the design of digital library for science or any other subject. Future areas for work include incorporating support for defining and adapting assessments as well as facilitating educators' search for materials targeting different student interests and learning styles. With more attempt to record concrete problem solving cases to use in other situations. The experts' comments agreed with Anderson (2010) the assignments created for Xen Worlds cover a variety of curriculum areas. Looking forward, there are several areas of Xen Worlds that could be improved or modified, the assignment library could be expanded to include additional

assignments, including more complex and open-ended assignments to increase the ways a student can explore the *VM*.

Flexibility: one of the experts (multimedia, MA. degree, more than seven years experience, university teacher) asked about the reason why Learners can't save at regular intervals and re-enter at any point. The researcher *agreed* and put this point in her mind for the future development stage.

Over all comments: the researcher *acknowledged* the following comments: one of the pedagogical experts thinks that the program is comprehensive, satisfaction, and clear. Other experts' multimedia, pedagogical, noted well, go ahead, overall work is good. Another multimedia noted the project is outstanding in terms of effort spent to put the material together. Another multimedia (Ph.D. degree, more than seven years experience, university teacher) said "Thank you for this work. It should open the door and open our eyes". Another pedagogical (Ph.D. degree, more than seven years experience, university teacher) noted "With all these observations, but you have hard conciliator most precious to you for your efforts".

Four recommendations for future ideas were collected from the over all comments:

The first one from multimedia expert was the possibility of integrating this system with the electronic systems management courses (Moodle in Al Quds University).

The second one from pedagogical was the integration of intellectual science fiction in this context. The researcher acknowledged these future ideas.

The third one from multimedia expert noted "hope fully you will successfully check its empirical effect practically". The researcher assured that the user evaluation phase will be the first step in empirical work, hopefully to be tested empirically to see the effect of such program on student achievement and attitude toward science and technology. As Pandith *et al* (2009) recommendation Software designers should keep the usability of all target users in mind.

The fourth one from another subject matter expert who was appreciated this work recommended "This program points out the importance of computer use in education, and we hope that this program is being circulated to other subject to be an educational tool in our schools". The researcher *acknowledged* this comment hoping doing for more subjects; the researcher for a short time reviews how this research has led to insights that may inform future work in the design of digital library for science or any other subject.

Action conclusions taken by the researcher:

The preliminary field test experts provided helpful feedback to the researcher for revising the *VM*. The researcher agreed with some experts' recommendation and they were taken into consideration:

The *VM* needed more virtual labs; more virtual labs were added, see appendix (M.2).
The *VM* needed more animations for some of the contents. More animations were added.

More fun worksheets; more were added. (See Appendices M.3)
Some pictures required; more were added. (See Appendix M.1)
The interface of the *VM* should be more attractive; more color to user interface screens were added (See Appendix M.1), and recommended use special program for user interface as future step.
More multimedia design of the front page; with website the front page will be more attractive.
The browse page is a limitation of the VM; the researcher agreed for future step and hope that the VM will eventually be available in an online Website.
Most evaluation is related to information, the researcher will add more about the skills in the near future.
Can't save at regular intervals and re-enter at any point? The researcher agreed and put this point in her mind for the future development stage.
The recommended a new technology (real life) that could have been used to enter a real museum virtually and do all these activities; agreed founded a lot of website which provided the opportunity to do virtual real lap, however, needed permission to log to such website, overall the virtual reality need special hardware which wasn't available for the researcher, and there is language such as VRML specially for this purpose, these need team to work together, and funded for such project this individual work is a sample for future idea.

The researcher disagreed with few points as weaknesses of the VM:

The ability to keep the content timely and current, the researcher explain that the VM in database had the ability to keep the content timely and current, with add, delete, and update records, but it is better to have it as website. It's very limited for some subjects. The researcher had taken five concepts with depth and interdisciplinary with other subject, the idea is flexible to be extended to other concepts and other subjects.

Wide range of the target group ages is expected to require a different consideration and contents in the suggested program the researcher explain that she had taken this point in her priority for different consideration, different content and different level from first grade to fourth grade. The information is beyond the level of the student; let him learn information that is beyond from their level.

The researcher acknowledged the following experts notes:

The recommendation that the VM an outstanding attempt could change the way of presented science to our children. It helps users of self learning and self dependent. Over all quality from multimedia view point is good. Appreciated the comprehensive use of teaching and learning technologies as an effective and attractive presentation of the elementary grades curriculum, it could accustom the student to study using computer, excellent work.

Links to other museums and educational resources could be as source for linking class in informal environment. Providing further interactions between student and the concepts throw different meaningful and enjoyable situations could be as informal environment to enhanced science and technology. The content is presented fairly logically, clearly, appropriately and simply.

The VM easy to read and it is clear and concise, the graphics appropriate,
This is an excellent tool for children to access information and self-assessment, there is no problem-solving assessment that the teacher look at what the student did at home and interact with that student, this is not the reason why this project is done, the student may learn at home by games and movies,… in this case the VM does not provide teacher assessment it is just self assessment.

The program is comprehensive, satisfaction, and clear. The project is outstanding in terms of effort spent to put the material together. It should open the door and open our eyes. With all these observations, but you have hard conciliator most precious to you for your efforts.

4.2 Revisions to Prototype

Revisions of the VM prototype were based on the data collected from the preliminary field test. There were major types of revisions that were considered during this stage. More virtual laps, more colors to user interface, more pictures, more animations, and more worksheets were added.

Revisions made to the VM as a result of the criticism of the preliminary field test experts added validity to the VM and the comments shared by the experts were seriously regarded and integrated into the revision. In other events that the researcher received feedback agreed for future step.

Chapter Five

5.1 User Evaluation Results and discussion

This chapter contains the findings and discussion; of user evaluation parents and children, the over all children comments, concluded the results related to over all children comments, the focus group interview, the relation of the study with other studies.

5.1.1. User evaluation parents:

The evaluation form was designed to collect data that would identify the strengths and weaknesses of the museum in terms of *general software quality evaluation, appearance, ease of navigation, ease of understanding the content, enjoyable, parent friendliness, integrating the technology lab into everyday, computer skill's, STS programmed characterized.*

Each parent was given a copy of the *VM*, a letter of instruction (see Appendix C.1), and the parents' instrument of evaluation (see Appendix, C.2,C.3).The parents were asked to determine the *VM's* general quality by rating the *VM* with the instrument and providing feedback comments. These data were used to determine the strengths and weaknesses of the *VM*. On the Yes/No scale a mean rating over 1.5 was considered "satisfactory" and anything below was considered "unsatisfactory", and over 70% percentage considered a satisfied domain.

II. Could the parents cooperate effectively to create a virtual museum which promotes science and technology in learning? This question was answered through the following sub-questions:

Q.1. What are the opinions of parents about the *VM*?
The findings related to this question of the user evaluation are demonstrated in the following.

Table 5.1: The number of parents, means and percentage of parent opinions for each domain.

Domain	No. of parents		Mean	Percentages opinion	
	Valid	Missing		No%	Yes%
General software quality evaluation	12	0	1.833	20.00	80.00
Appearance	12	0	1.960	15.76	84.24
Navigation	12	0	1.800	20.00	80.00
Content	12	0	1.786	21.43	78.57
Enjoyable	12	0	1.847	19.93	80.06
Parent friendliness	12	0	1.867	19.00	81.00
Integrating the Technology lab into everyday	12	0	1.952	16.70	83.33
Computer skill's	12	0	1.833	19.98	83.35
STS programmed characterized	12	0	1.803	21.66	78.34
Over all evaluation form	12	0	1.842	19.50	80.50

The results in Table (5.1) show that the *content* was the lowest satisfaction with a mean of 1.786. 78.57% of the parents found that the *VM Content* was convention, while 21.43% found it wasn't. *Appearance* was the highest satisfaction domain with mean of 1.960. 84.24% of the

parents found the *VM appearances was suitable*. The parents' evaluation test yielded positive feedback from regarding the *VM*'s instrument evaluation for revision domains. The parents found that the VM appropriation. None of the domains have an unsatisfying rating; all of them have a mean greater than 1.5 and more than 70.00%.

Out of 12 parents surveyed, 80.00% of the parent found the *general software quality* evaluation was suitable while 20.00% found it unsuitable. 80.00% of the parent found the *navigation* domain was suitable, while 20.00% found it wasn't. 80.06% of the parent found the VM was enjoyable, while 19.93% found it wasn't. 81.00% of the parent found the VM *parent friendliness*, while 19.00% found it wasn't. 83.33% found the VM appropriated to *integrate the technology lab into everyday*, may 16.70% found it wasn't. 83.35% found the VM helped the children achieved *computer skill's* domain, while 19.98% found it wasn't. 78.34% found the VM was characterized by STS standards, while 21.66% it wasn't. Finally 80.50% from the parent satisfied the *over all evaluation form*, while 19.50% wasn't. In the *content* domain which was the least satisfactory, there are a couple of unsatisfactory items: "familiar" (58.30%) and "well organized" (66.70%) (See appendix I). contradiction of that the children results showed that the content was the highest satisfied domain as clarified later.

To answer the following questions the researcher has utilized the nonparametric Kruskal Wallis Test.

Q.2. Is there any significant difference in parents opinions related to academic qualifications (diploma, B.A, upper than B.A)?
For answer this question see table (5.2):

Table 5.2: Kruskal Wallis test, grouping variable: Parents qualification, subject = parent

	Chi-Square*	Asymp. Sig.
General software quality evaluation	5.928	0.115
Appearance	3.740	0.291
Navigation	1.476	0.688
Content	7.051	0.070
Enjoyable	5.019	0.170
Integrating the Technology lab into everyday	4.689	0.196
Computer skill's	7.734	0.052
STS* programmed characterized	1.247	0.742
Parent friendliness	4.025	0.259
Over all evaluation form * df=3	2.740	0.433

The results in table (5.2) show that significance levels over 0.05 indicate that the parents are similar in their opinion toward the VM in relation to academic qualifications (lower than two-year diploma, diploma, B.A, upper than B.A). With taken the *over all evaluation form* significance value is greater than 0.05 so there is no significant different in parents opinions related to academic qualifications.
Q.3. Is there any significance different in parents opinions related to their child grade (first, second, third, fourth)?

For answer this question the researcher used Kruskal Wallis Test see table (5.3)

Table 5.3: Kruskal Wallis Test, Grouping Variable: Child grade, Subject = Parents

Domains	Chi-Square*	Asymp. Sig.
General software quality evaluation	4.033	0.258
Appearance	1.970	0.579
Navigation	3.995	0.262
Content	4.201	0.241
Enjoyable	.944	0.815
Integrating the Technology lab into everyday	1.267	0.737
Computer skill's	2.738	0.434
STS* programmed characterized	3.872	0.276
Parent friendliness	.831	0.842
Over all evaluation form *df=3	1.122	0.772

The results in table (5.3) show that the significance levels over 0.05 indicate the parents were similar in their opinions toward the VM in relation to their child grade.

Q.4. Is there any significance different in parents opinions related to child achievement (weak, good, very good, excellent)?
For answer this question the researcher use kruskal Wallis Test as see table (5.4)

Table 5.4: Kruskal Wallis Test, grouping variable: Childs achievement, subject = parents

Domains	Chi-Square*	Asymp. Sig.
General software quality evaluation	1.039	0.792
Appearance	6.189	0.103
Navigation	3.894	0.273
Content	3.162	0.367
Enjoyable	3.167	0.367
Integrating the Technology lab into everyday	2.356	0.502
Computer skill's	3.619	0.306
STS* programmed characterized	3.964	0.265
Parent friendliness	2.620	0.454
Over all evaluation form *df=3	4.668	0.198

The results in table (5.4) show the significance levels over 0.05 indicate that the parents' opinions were similar. In this case the child grades didn't change the opinions of the parent.

5.1.2. User evaluation children

The creation of the virtual science museum exhibition is a process that is not completed with just the building, design of the *VM*, and experts' refinement, but must also incorporate feedback from the users who will utilize the *VM*. The evaluation form was designed to collect data that would identify the strengths and weaknesses of the museum in terms of *general software quality evaluation, appearance, ease of navigation, ease of understanding the content, enjoyable, integrating the technology lab into everyday, computer skill's, STS programmed characterized.*

The children were asked to act as experts and evaluate the system on a voluntarily basis, using a simplified instrument of evaluation, each children was given a copy of the *VM*, a letter of instruction, and the instrument of evaluation (see Appendix D.1, D.2). Children were asked to determine the *VM*'s general quality by rating the *VM* with the instrument and providing feedback comments. These data were used to determine the strengths and weaknesses of the *VM*. On the Yes/No scale a mean rating over 1.5 was considered "satisfactory" and anything below was considered "unsatisfactory", and over 70% percentage considered a satisfied domain.

The following question were answered in order to evaluate the usability and children acceptance of the *VM*

Q.1. What are the opinions of children about the *VM*?

The means and the percentages opinions calculated of the children to answer this question as show in table (5.5).

Table 5.5: number of children, means and percentages of children opinions for each domain.

Domains	No. of children		Mean	Percentages opinions	
	Valid	Missing		No%	Yes%
General software quality evaluation	100	0	1.938	8.22	93.58
Appearance	100	0	1.907	10.14	89.86
Navigation	99	1	1.913	08.70	91.30
Content	100	0	1.980	02.00	98.00
Enjoyable	99	1	1.955	07.00	93.00
Integrating the Technology lab into everyday	99	1	1.905	07.45	81.91
Computer skill's	99	1	1.923	09.38	92.18
STS programmed characterized	99	1	1.926	09.14	91.52
Over all evaluation form	99	1	1.925	08.05	91.86

Out of 100 children surveyed, the results in Table (5.5) show that *integrating the technology lab into everyday* was the domain with least satisfaction with a mean of 1.905. 81.91% of the children found that the *VM* helped the children integrating the technology lab into everyday, while 7.45% found it wasn't. Content was the domain with the highest satisfaction with a mean of 1.98. 98.00% of the children found the content suitable, while 2.00% found it wasn't. The children' evaluation test yielded positive feedback from regarding the *VM's* instrument evaluation for revision domains. Children found that the *VM* appropriation. None of the domains have an unsatisfying rating; all of them have a mean greater than 1.5 and more than 70.00%.

93.58% of the children had found the *general software quality evaluation* was suitable while 8.22% found it wasn't. 80.00% of the children found the *Navigation domain* was suitable, while 8.70% found it wasn't. 93.00% of the children found the *VM* was enjoyable, while 7.00% found it wasn't. 92.18% found the *VM* helped in satisfied Computer skill's, while 9.38% found it wasn't. 91.52% found the *VM* was characterized by STS standards, while 9.14% it wasn't. Finally 91.86% of the children satisfied the over all evaluation form domains, while 8.05% weren't.

The content from the view point of the children was accurate, clear, familiar, appropriate, well organized, educational value is high, and Easy to understand. The reason is cleared the researcher prepared the content in referenced to pilot study result and after analysis the content from the first grade to second grade to linking the VM as informal teaching with the formal once. 95.00% of the children said the content was familiar, 98.00% said the content was well organized (see Appendix J). The reason why the contradiction between parents and children that it isn't necessary what desired the parents desired the children.

Museum developers, according to Hennes, need not find ways of creating a demand for the material; rather, they must find a way to capture the visitors' attention. Rather than being driven by the theory of constructivism, the designers' objectives were driven by the law (Hennes, 2002, p. 115). So, as the feedback from the children, the researcher began to better understanding of what the children wanted from VM as informal learning. Providing feedback from the perspective of *VM* users make meaning to the data. As the researcher desired to have a better understanding of the children' needs, to reconsideration of the way the *VM* is satisfied and evaluated.

The finding in this study shown that 95.5% of children found the VM enjoyable this result successor was over compatible with the results reported by Shim *et al* (2003) more than 50% of students said that studying biology using the VRBS provided enjoyment. The results agreed with Anderson (2010) results indicate students feel the environment is an enjoyable and effective teaching method, and many students consider it a valuable tool for learning, and reinforcing class material. The results shown in Evans and Sterry (1999) when questioned over 90% of visitors from the computer group expressed the opinion that they had enjoyed using the portable computer and that it had been easy to use. Other elements mentioned positively regarding ease of use were the flexible and straight forward structure of the application, clear buttons, help system and the location map. The Videos/Animations were the most liked feature of the multimedia application, being identified by 44% of visitors. Also mentioned positively was the access to information, ease of use, visual screen design and audio narration. And 92% that they had learn more using the computer than they would have done otherwise.

Q.2. Is there any significant difference in children opinions related to child grade (first, second, third, and fourth)?

Table 5.6: Kruskal Wallis Test, grouping variable: Child grade, subject = children

Domains	Chi-Square*	Asymp. Sig.
General software quality evaluation	2.286	0.515
Appearance	2.921	0.404
Navigation	3.054	0.383
Content	2.062	0.560
Enjoyable	2.903	0.407
Integrating the Technology lab into everyday	2.373	0.499
Computer skill's	4.055	0.256
STS* programmed characterized	2.210	0.530
Over all evaluation form *df=3	3.274	0.351

Table (5.6) show the significance levels over 0.05 indicate that the children opinions were similar according the children grade, the children grade didn't change the opinions of the children.

Suggesting that fourth grade participants perceived the VM as a greater opportunity to task interact than first grade participants, they are more satisfied. Regarding grade, no significant, differences are found. This outcome was not surprising considering the technology competent and homogeneous experience focus of the children in the information age. Children are born with a curiosity about new and unusual things. They have seen to be attracted to computers.

Q.3. Is there any significant difference in children opinions related to child achievement (weak, good, very good, and excellent)?

Table 5.7: Kruskal Wallis Test, grouping variable: Childs achievement, subject = children

Domains	Chi-Square*	Asymp. Sig.
General software quality evaluation	1.078	0.782
Appearance	11.592	0.009
Navigation	12.458	0.006
Content	10.063	0.018
Enjoyable	11.149	0.011
Integrating the Technology lab into everyday	11.347	0.010
Computer skill's	10.369	0.016
STS programmed characterized	10.463	0.015
Over all checklist children *df=3	6.626	0.085

Table (5.7) show the significance levels over 0.05 indicate that the children opinions were similar according the children achievement, the children achievement didn't change the opinion of the children.

Using computer program with multi learning style could be a solution for lower achiever to getup and go ahead. A clear evidence from the open comments: One from fourth grade "weak achiever" wrote that it might help him in improving her achieve; "I love computers and enjoy doing may help me to improve my scores and benefit the information, I see it better from the book". So computer program which call different learning style could help the student improving there learning.

Over all children comments:

The comments were translated by a judgment translator (see appendix K) the origin comment. The researcher regrouped students' comments as following:

Several of students (14%) provided various answers like: beautiful, wonderful, easy, teaches us a lot, I liked it and I liked it so much. For example one of them very good achiever from third grade said that it was beautiful, wonderful and teaches us a lot of things. Another's one good achiever from third grade stated that the *VM* "Beautiful and wonderful, Beautiful and very cool". Other one excellent achiever from third grade commented that it was "plain beautiful love him so much".The researcher expressed her thanks to them. The result of this study agreed with Pappa and Pannese (2010) provide a familiar environment for the latest generation of students.

The researcher ensured several students (10%) that she will provide the participating schools with a version of it as soon as she finishes its amendments after discussing the thesis. they wrote in their notes that the hope that the school would provide it, or the hope to get it. Par example one student good achiever from second grade stated that "I ask the teacher to be attended to class". Another one excellent achiever from third grade commented "I hope that I get it".

Few students (3%) wrote that they will ask their parents to bring them it. The researcher told them that she will provide them with versions of it to thank them for their participation in the evaluation of the program. For example one student very good achiever from first grade "I'll tell my mother about the VM to bring it to me". Another good achiever from fourth grade stated "I will ask my father to bring me one like it",.

Several students (14%) wrote about their hopes that this program to be available for other subjects likes Arabic, English, Maths, even History and other subjects. The researcher confirmed that she will recommend working more, and she will design one for Maths as soon as possible, with the knowledge that she is currently designing one for the disabilities. One very good achiever from fourth grade stated "I hope that there will be for maths and Arabic one like him", another from second grade "very good achiever" commented "We hope to get more subject".

A number of students (18%) gave various answers between their love to Science and learning about Science through the program, and that it made them love Science more, and that Science is wonderful. The researcher commented that loving Science is an honorable objective for nation's success, and it might be the secret of the developed states success. One excellent achiever from third grade stated that "the *VM* makes me love science more". Another good

achiever from third grade wrote “I loved it for science; science wonderful makes me love science more”. As Yörük *et al* (2009) concluded that chemistry education in relation with science, technology, society and environment would lead students to choosing different fields for their future careers by changing their perspectives towards science. SCHERZ and OREN (2006) findings demonstrate that the IST program stimulated a positive effect on students’ images.

One student excellent achiever from second grade wrote that the program achieves the standards of Science. The researcher got surprised by this comment, particularly from a child in the second grade; here is his comment “Beautiful, I hope that the school will provide it, the program achieves the standards of Science.”

The researcher thanked Two of the students from fourth grade one very good achiever the other excellent achiever wrote about the photos that they are useful and good.

Few students (5%) wrote that they enjoyed the scientific songs and films and games, one of them good achiever from second grade wrote “I enjoy films”. As Frenshs’ (2007) Visitors also felt positively toward using video game technology as learning tools. This opens opportunities to developing chemistry exhibits using video technology to lessen the waste stream produced by a full scale chemistry exhibit. Like Laghos’ result (2010) that the children liked the colors and animations in the game.

The researcher acknowledged several of them (9%), one excellent achiever from first grade wrote the following: “Like everything, everything is beautiful tutorial, we identify the parts of the plant is sweeter we learned how to grow the tree. We take information”.
Others wrote that it helped them in study and it was better than the textbook, one of them good achiever from first grade stated “we under stand from the VM faster than the book”.
Another excellent achiever from fourth grade wrote the following: “This program was excellent and wonderful and helpful, and I have enjoyed in this program, I hope that I can repeat this fun and useful idea of the human mind and I hope, more”. Another two excellent achievers from second grade wrote that, it was very funny. One student excellent achiever from third grade wrote the following: “I enjoyed a lot and thank you very much”.

Two wrote about the program details, the first excellent achiever from fourth grade wrote the following: “We were interning in the computer, and identified sites the eye, and we saw the planets and our solar system, and read about the solar system, and we saw a film about animals and aquatic organisms such as: whale, reptiles, etc., and we have seen, also a film about the eye how to move the image to the brain, and I hope to repeat this idea”. The second excellent achiever from first grade stated “I enjoyed myself a compass construction of the museum that's great, I will collect pictures and ideas for work one with myself”.

The researcher very pleasured from One from fourth grade “weak achiever” wrote that it might help him in improving her achieve; “I love computers and enjoy doing may help me to improve my scores and benefit the information, I see it better from the book”. Another one excellent achiever from fourth grade wrote “I will write in the book of memoirs about this”. Just like exploring a new place, children explore computer and this aspect of their development makes it significantly easier for them to be taught with. Furthermore, it has been

observed that students are more focused and task oriented when working with computers (Snyder, 1994).

The various comments with details in Arabic as the student stated in Appendix (J.1).

Concluded over all children comments:

Beautiful, wonderful, easy, teaches us a lot.
Hope that schools or parents would provide it.
Hope that this program be available for other subjects.
Love science and learning about Science through the program.
Made them love Science more, and that Science is wonderful.
The program achieves the standards of Science.
The photos are useful and good. Enjoyed the scientific songs, films and games.
The VM helped in study. The VM was very funny.
Interesting in the computer, and identified sites the eye, planets, solar system, animal.
Enjoyed a compass construction of the museum.
Love computers and enjoy it may help to improve scores and benefit the information.
It was better from the text book.
Write in the book of memoirs about the VM.

Focus group interview:

After finishing the experiment, a half-hour focus group interview was conducted to elicit these students' in-depth perceptions towards the use of the VM. 10 participants were selected for the interview with two or three participants at a time; the researcher has noted what they have said.

The children interview confirmed that the children were very excited with the use of the VM. One of the children good achiever in second grade commented that it was his first time that he enjoyed such a learning task because he loved the game-like VM. Other one achiever weak from third grade also stated that they enjoyed the VM as they found it more interesting than learning from the textbook.

The children also stated that the VM helped them understand the subject content better. One of them good achiever from fourth grade reported that "Although I have to spend much more time in learning the scientific concepts but I think I have learnt better because VM allows us to explore and discover information, I like science through this program very much". Another child very good achiever from third grade said that "Now I know different planets have different sizes, different color. Jupiter is the most beautiful planet in the Solar System". An additional student excellent achiever from fourth grade commented, "Now I am able to visualize how the nine planets revolve around the Sun. I prefer to study Science in this way than the normal tradition classroom teaching".
Another good achiever from second grade stated "I enjoyed the construction part of the VM that's great idea for every one to have personal museum with his own collection, I will do one".

Another good achiever from fourth grade stated that he was able to make use of the search engine more effectively in gathering information; this encouraged him to go online to search for information whenever he faced problems in understanding abstract scientific concepts.

The interview results indicated that the students loved the interactivity feature "dialog box each one write his explication to see the other one".
The students also expected that this VM would be used in other science topics or other subjects. One of them very good achiever from third class commented that the VM was so interesting and enjoyable that more learning tasks would adopt this approach. They agreed that using game could make learning more fun. There hopes that this program to be available for other subjects likes Arabic, English, and Math. The students interviewed also confirmed the difficulties they met in some subjects in science text book like Solar System, eye subject, one of them good achiever fourth grade said that it let me learn better specially about the eye and how the picture is formed in the brain. Another one very good achiever from fourth grade said that he like very much the part of technology how camera function look like eye function, and how to do telescope at home.

User evaluation finding confirmed significance of this technique, as experts evaluation confirmed that the VM was satisfied. In addition, children showed a preference to using technology to learn about science and, they were much enjoyed in the VM reading scientific information, or to do an expert. The expert as the user expected more and more. Ang and Wang (2006) support this finding in that they found the results showed that the students were engaged in the learning task and expected more topics, As Osberg's *et al* (1997) result "All of the students wanted more of everything; more time, more. And the information presented in the virtual space was accurate.

More applications it is evident from this study that children showed a preference towards *VM* exhibits that include interactive entertainment. According to Shaffer *et al*. (2005), the next challenge for game and school designers alike is to understand how to shape learning in terms of games, and how to integrate games and game-based learning environments into the predominant arena for learning (p. 16). The researcher suggested a design team to begin to incorporate additional interactive learning games.

The results of the study agreed with Delellos' (2009) Students showed a greater interest level in learning science with technology through online gaming and rich multimedia suggesting that virtual science museums can be educationally valuable and support an alternative to traditional teaching methods if designed with the end user in mind. So the designed of *VM* is more important than construct conception Museum developers.

As Prosser and Eddisfords' (2004) findings from Burma and Virtual Victorians show that the virtual objects did not diminish but promoted an appreciation of the value of physical objects and of displaying them in museums.

As Pribeanu *et al* (2009) data collected with the usability questionnaire reveals several positive aspects. ARTP has educational value: the system is good for understanding, good for learning, good for testing, and makes it easier to remember the lesson. The system makes

learning faster. ARTP is increasing the students' motivation to learn: the system is attractive, stimulating and exciting, exercises are captivating and the system makes learning less boring.

5.2 Final Product Revision

A final revision of the VM was made based upon the results of the main field test. The recommendations were made by the product's targeted group, which were analyzed and considered for future steps like provide the VM to the participants' schools and children. More programs to be available for other subjects likes Arabic, English, Maths, even History and other subjects; more scientific songs, films, photo, and games to be included in the VM; More enjoyable program to improve scores and benefit the information. Need more concept and subject, the evaluation of the *VM was* acceptable and enjoyable as it was, students showed a greater interest level in learning science with technology through gaming and multimedia suggesting that virtual science museums can be educationally valuable and support an alternative to traditional teaching methods if designed with the end user in mind. The results of the study was included the final version of the *VM.* This version will be provided to each of the proof of concept experts, the preliminary field test leaders and the main field test reviewers.

The next chapter present conclusion of the results and recommendation from preliminary field test, conclusion the result and recommendation from user evaluation test, recommendations are offered for further research, and recommended Principles to the Design of Virtual Museum.

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Chapter Six

6.1. Conclusions and recommendations

This chapter contains: Conclusions, and Recommendation from; preliminary field test, user evaluation test, research result, recommendation for future research, and recommended Principles to the Design of Virtual Museum.

6.1.1. Preliminary field test:

The preliminary field test yielded positive feedback from experts regarding the *VM's* instrument evaluation for revision domains. The various experts (Pedagogical, Subject matter Expert, and Multimedia Expert) have similar opinions toward the VM. The experts are similar in their opinion toward the VM in relation to academic qualifications (B.A. degree, MA. degree, Ph.D. degree). The experts are similar in their opinions toward the *VM* according to experience level (less than four years, from four to seven years, more than seven years). The experts similar in their opinions toward the *VM* evaluation in relation to professional roles (school teacher, university teacher).
The open results from preliminary field test suggest that the VM could be informal learning environment. Due links to other museums and educational resources could be as source for linking class in informal environment, the interactions between student and the concepts throw different situations. Expect that it will affect the teaching science and technology. And it was Exceptional in terms of introducing virtual museum to this level who fast loss attention to encouraged them to study; helps users of self learning and self dependent. Which is suitable for many learning style. Builds some skills and develop scientific thinking skills. Easy to use with colored interface. Indicated that the content is presented fairly logically, clearly, appropriately, familiar and simply. The text in the VM easy to read and it is clear and concise, the graphics appropriate. This work should open the door and open the eyes.
However, further explorations and evaluations will be necessary to evaluate the effectiveness STS to address matters of science, technology and society; increasing the application for higher level of thinking, the need to develop the child's ability to creative thinking and production of new knowledge, more social interaction.

6.1.1.1 Recommendation from preliminary field test:

More activity that encourage higher level of thinking and more social interaction, develop the child's ability to creative thinking and production of new knowledge:

- The interactive VM is conventionally assumed to be used by one user at a time, to further encourage the social interaction and shared cognition process simple games and puzzles could be designed that allow inputs from 3 to 4 persons in a group.
- Proposed interactive VM software in order to offer higher level of learning and engaging user experience.

- The assignment library could be expanded to include additional assignments, including more complex, higher level of thinking, more problems solving, skills assessments to increase the ways a student can explore the VM environment.
- Future areas for work include incorporating support for defining and adapting assessments as well as facilitating educators' to search for materials targeting different student interests and learning styles.
- Follow up students' progress when the students do the exercises.
- Add more games for this age, more virtual lap.
- Study the idea of the possibility of integrating this system with the learning management system "Moodle in Al-Quds University".
- Integration of intellectual science fiction in this context.
- Save at regular intervals and re-enter at any point.
- Improving the VM website, not only the VM software.
- Circulated the VM to other subject to be an educational tool in our schools.
- Inform future work in the design of digital library for science or any other subject.

6.1.2. User test evaluation:

The parents' evaluation test yielded positive feedback from regarding the *VM*'s instrument evaluation for revision domains. Parent found that the VM appropriation. The parents were similar in their opinion toward the VM in relation to academic qualifications. The parents were similar in their opinions toward the VM in relation to their child grade.

The children' evaluation test yielded positive feedback from regarding the *VM's* instrument evaluation for revision domains. Children found that the VM appropriation. None of the domains have an unsatisfying rating; all of them have a mean greater than 1.5 and more than 70.00%. The children opinions were similar according the grade. The children opinions were similar according the achievement.
Children comments showed a greater interest level in learning science with technology through gaming and multimedia suggesting that virtual science museums can be educationally valuable and support an alternative to traditional teaching methods if designed with the end user in mind. Better supported by children interview confirmed that the children were very excited with the use of the VM which helped them understand the subject content and navigate to search scientific information.

6.1.2.1 Recommendation from user test evaluation:

- Provide the VM to the participants' schools and children.
- More programs to be available for other subjects likes Arabic, English, Maths, even History and other subjects.
- More scientific songs, films, photo, and games.
- More enjoyable program to improve scores and benefit the information.

6.1.3. Recommendation from the results:

Future work includes expanding the learning activities, identifying ways to streamline the preparation of learning activities, and identifying the impact *VM* has on learners' different learning styles. How students and teachers develop and extend their learning experiences when given access to virtual museum. Challenges and difficulties teachers face in integrating these types of program and content into conventional curriculum and classroom structures. Such an implementation strategy would build a foundation for transposing the research from laboratory studies to robust, practical implementations. Thinking now about eventual deployment and dissemination is vital. Due to the huge profits of the computer programs market and the entertainment industry.

6.1.4 Recommendation for future research:

- Explore virtual museum projects that partner with pedagogical, subject matter that have materials appropriate for the *VM*, for various subjects and materials.
- Develop a flexible model that specifies a variety of technology solutions like virtual realty for various virtual museum capabilities and the level of funding, training, and technical support each component requires.
- Determine the effectiveness of virtual museum in project-based collaborative learning environments.
- Examine how students' science knowledge operates as a basis for new academic knowledge in virtual museum projects.
- Examine how the virtual museum affects students' motivation, learning styles, and attitudes towards science and technology.
- Assesses how the virtual museum project enhances students' scientific and technology literacy.
- Examine how technology operates as a literacy responsive element in virtual museum projects.
- Investigate the effects of virtual museum projects on formal teaching programs.

6.1.5 Recommended Principles to the Design of Virtual Museum:

Based on the research conducted in this thesis and to ensure well-designed virtual museum units, the researcher recommends the following design principles:

- The design of such units should ensure the cooperation of three experts: Pedagogical; Subject matter; and Multi Media.
- It should incorporate large degree of interactivity.
- A database-driven service with many learning styles.
- Incorporate a flexible model that specifies a variety of technology solutions like virtual realty for various virtual museum capabilities and the level of funding, training, and technical support each component requires.
- Incorporate project-based collaborative learning environments.
- Include evaluation form with specific criteria

Created VM should be:

- With rich content, cover a broad range of topics, content and context must be consistent with the theme, Encourages higher levels of thinking, enables students to investigate important concepts in depth. Makes meaningful connections between different content areas as well as to real-life situations, free of errors in grammar, spelling, usage, etc.
- User friendly, assure the technical Aspects (The screen displays are easily understood. The screen displays are attractive. Exiting the program is easy).
- Interactive colored, well designed. Graphics, high multimedia quality, the software uses media effectively (audio, graphics, video).
- Accommodates various learning styles, ability levels, activities and approaches are appropriate for specific topics.
- Enjoyable, Engagement/ Interactivity Requires learners to become actively engaged in order to learn. Text employs multimedia enhancements to interactive learning. Provides appropriate feedback: informative and timely. Motivates the learner to master concepts. The supplementary teaching materials contain strategies for integration with other content of disciplines (for example, English, Technology, and Art) into the instructional concept.
- Offer Teacher & Learner Support Materials. Provide students with additional suitable resources such as web sites, bibliographies, etc. Easily track student's progress through feedback
- Offer Challenge Appropriate assessment methods. Suited to learning goals. Assess students' progress through evaluating the outcomes provided within the product
- Appropriate for target audience. The content is appropriate for target audience. The product is suitable for the age and grade level. Directions are clear/ complete to perform required tasks Mechanics of the program (instructions, response mode, feedback, and graphics) are appropriate for the target population. The product is suitable for different learning style.
- Flexible Learners can save at regular intervals and re-enter at any point. The aspects of VM can be integrated into classroom activities. The students use it by themselves. The program could be used collaboratively. Provides multiple opportunities for hands-on experiences Provides information on educational activities to do at home.

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Appendix (A.1)

The pilot study English version

The researcher built a computerized program "virtual museum" intending the lower basic school students to help them invest a passion for technology in learning science and the application of some concepts in practice in informal environment.

Teacher specialization:
Years of Experience:
Theme I: Aims to identify your opinion in the educational contributions of the computerized programs for both the learner and the teacher as will as educational goals.
Theme II: targeting to identify your suggestions to design educational programs.
Theme III: open-ended question " ".

Theme I:
Contributions of educational programs offered by the computer for each of the learner and teacher as will as educational outcomes.

Yes\NO	**For the learner:**
	Building his own knowledge Sense of responsibility for self-learning Interaction with learning material Concentration of attention during learning Enjoy the learning process Creative thinking during learning
	For the teacher:
	The organization of learning process. Identify the learning sources. Monitor the behavior of learners during learning. Raise the motivation of learners to learn. Design the learning environment. Guide students during the learning.
	Educational computer programs could contribute in the achievement of the following outcomes:
	Develop the ability of visual perception. The trend towards the development of discovery learning. The trend towards the development of self-learning. The development of attitudes toward learning. Develop the capacity to understand the processes and concepts and abstract ideas. Development of problem-solving skills. The development of thinking ability. Develop the capacity to conclude. Develop the capacity to imagine. Highlight the relationship between science and technology.

Theme II:

Yes\No	To design educational programs that are dealing with:
	Three-dimensional visual perception and imagination. Settings those are difficult to be realistic. Increasing or decreasing dimensions to facilitate learning. Visualizing the internal construction of objects. Conducting experiments that are difficult to be applied in real. Concentrating attention significantly. Frequently presentation to facilitate understanding. Embodiment of abstract concepts those are difficult to access through the sense. Allows the student to apply the experiment by himself in home or school. Allowing the student to simulate the phenomena and events, which are difficult to be learned directly.

Theme III:

The open question:

Other suggestions you would like to add with regard to concepts that need to be computerized for linking science with technology in an informal learning environment?

(Appendix A.2)

The Pilot study Arabic version

دراسة استطلاعية:

تقوم الباحثة ببناء برنامج محوسب "متحف افتراضي" يستهدف طلاب المرحلة الأساسية الدنيا وذلك لمساعدتهم على إستثمار شغف التكنولوجيا في تعلم العلوم وكذلك تعويدهم على مهارات الحاسوب وتطبيق بعض المفاهيم عمليا في بيئة غير رسمية.

تخصص المعلم:

عدد سنوات الخبرة:

المحور الأول: يستهدف التعرف على آراءك في الاسهامات التربوية التي تتيحها برامج الحاسوب لكل من المتعلم والمعلم والأهداف التربوية.

المحور الثاني: يستهدف التعرف على مقترحاتك لانتاج برنامج محوسب.

المحور الثالث: سؤال مفتوح " ".

المحور الأول: الاسهامات التربوية التي تتيحها برامج الحاسوب لكل من المتعلم والمعلم والمخرجات التربوية.

نعم/لا	**بالنسبة للمتعلم:**
	بناء معرفتة بنفسه.
	الشعور بمسؤوليته الذاتية عن تعلمه.
	التفاعل مع مادة التعلم.
	تركيز الإنتباه أثناء التعلم.
	الاستمتاع بعملية التعلم.
	التفكير اثناء التعلم.
	بالنسبة للمعلم:
	تنظيم عملية التعلم.
	تحديد مصادر التعلم.
	رصد سلوك المتعلمين أثناء التعلم.
	إثارة دافعية المتعلمين للتعلم.
	تصميم بيئة التعلم.
	توجيه الطلاب أثناء التعلم.
	برامج الحاسوب يمكن ان تسهم في تحقيق المخرجات التربوية الآتيه:
	تنمية القدرة على التصور البصري.

	تنمية الإتجاه نحو التعلم بالاكتشاف. تنمية الإتجاة نحو التعلم الذاتي. تنمية الإتجاة نحو مادة التعلم. تنمية القدرة على فهم العمليات والمفاهيم والافكار المجردة. تنمية مهارات حل المشكلات. تنمية القدرة على التفكير. تنمية القدرة على الاستنتاج. تنمية القدرة على التخيل. تمييز العلاقة بين العلم والتكنولوجيا.

المحور الثاني: يستهدف التعرف على مقترحاتك لانتاج برامج الحاسوب.

	أن تنتج البرامج التعليميه لتناول المواضيع التي تحتاج الى:
	التصور والتخيل البصري ثلاثي الأبعاد. تجهيزات يصعب توافرها في الواقع. تغيير الأبعاد بالزيادة والنقصان لتسهيل التعلم. رؤية البناء الداخلي للاشياء. اجراء تجارب يصعب اجراؤها في الواقع. تركيز الانتباه بدرجة كبيرة. تكرار العرض لتسهيل الفهم. تجسيم المفاهيم المجردة التي يصعب الوصول اليها من خلال الحواس. تتيح للطالب اجراء التجربة بنفسة في البيت او المدرسة. السماح للطالب محاكاة الظواهر والاحداث لتي يصعب تعلمها بطريقة مباشرة.

المحور الثالث: السؤال المفتوح:

مقترحات أخرى تود اضافتها فيما يتعلق بالمفاهيم التي بحاجة الى حوسبه لربط العلوم بالتكنولوجيا في بيئة تعلم غير رسمي؟

Appendix (B.1)
A letter to participants "Experts"

Dear

The researcher would like to conduct this study as part of her requirements for master degree in teaching methods at Al-Quds University. The main purpose of the study is to develop Virtual Museum "VM" for lower Basic grades as a tool of science and technology literacy in informal environment, the researcher mainly want to gain insight into Virtual Museum from the perspective of the participants.

You will receive two forms (Electronic and manual) you have the choice to respond on one of them.
The researcher hopes that you will respond to each item in the evaluation form honestly and seriously. The researcher assures you that your response will be confidential and will be used for the purpose of this research only.

Thank you for your cooperation in advance

With best regards

Researcher
Bushra Al-badawi

Appendix (B.2)
Virtual Museum Experts Evaluation Form

This checklist has been built based on many sources, Please note that the more items you check the better the software is, the unchecked items are the issues that need to be considered. All requirements of a given item should be met before the next section is attempted.

The first part

Please indicate expertise in the field of virtual learning by clicking one

- **Expert in:**

☐ Science educators or pedagogical.
☐ Subject matter expert.
☐ Multimedia expert.
☐ Others.

- **Academic qualification**:

☐ B.A. degree.
☐ B.A. degree & diploma in education.
☐ MA. degree.
☐ Ph.D. degree.
☐ Others.

- **Experience levels:**

☐ Less than four years.
☐ From four to seven years.
☐ More than seven years.
☐ Others.

- **Professional roles**:

☐ School teacher
☐ School principal.
☐ University teacher.
☐ Others.

The second part:
Could you please click Yes or No

	Yes| No
Content & Educational Value	☐ ☐ Accurate ☐ ☐ Complete ☐ ☐ Well organized. ☐ ☐ Presented clearly. ☐ ☐ Meaningful ☐ ☐ Relevant. ☐ ☐ Has obvious educational value. ☐ ☐ Facts come from reliable sources which are clearly identified. ☐ ☐ Content and context are consistent with the theme. ☐ ☐ All information relates to the stated purpose / learning goals. ☐ ☐ Encourages higher levels of thinking. ☐ ☐ A broad range of topics is covered. ☐ ☐ Enables students to investigate important concepts in depth. ☐ ☐ Makes meaningful connections between science and other content areas as well as to real-life situations. ☐ ☐ Free of errors in grammar, spelling, usage, etc.
Curriculum Connections	☐ ☐ National standards are accessible with easily linked to instruction. ☐ ☐ Objectives are clearly stated on Entry Form ☐ ☐ Clear evidence of connection to target curriculum ☐ ☐ List prerequisite skills. ☐ ☐ Use real world examples to make the instruction relevant. ☐ ☐ Complies with subject based guidelines
Graphics/ Multimedia	☐ ☐ Graphics are well designed ☐ ☐ Graphics are rendered to enhance learning ☐ ☐ Background and text are compatible ☐ ☐ Text is easy to read ☐ ☐ Graphics are consistent, appropriate designed to optimize

	learning ☐ ☐ Colors are used in an effective way ☐ ☐ Animation always complements learning. ☐ ☐ The software uses media effectively (audio, graphics, video). ☐ ☐ Multimedia directly related to stated purpose /learning goals.
Lay-out	☐ ☐ Clear. ☐ ☐ Spontaneous. ☐ ☐ Easy to navigate through the information to find necessary features. ☐ ☐ Appropriately sequenced "logical". ☐ ☐ Consistent on all pages.
Technical Aspects	☐ ☐ Links work suitably. ☐ ☐ Possible to work in most common browsers ☐ ☐ All multimedia resources work properly. ☐ ☐ Users are able to access software easily. ☐ ☐ Users are able to install software easily. ☐ ☐ Clear/ complete directions are available for access. ☐ ☐ The screen displays are easily understood ☐ ☐ The screen displays are attractive. ☐ ☐ Exiting the program is easy.
Adaptability/ Accessibility	☐ ☐ Paragraphs and sections have clear/ accurate informative headings. ☐ ☐ Clear fonts are used consistently. ☐ ☐ Accommodates various learning styles. ☐ ☐ Accommodates various ability levels. ☐ ☐ Activities and approaches are appropriate for specific topics.
Engagement/ Interactivity	☐ ☐ Requires learners to become actively engaged in order to learn. ☐ ☐ Text employs multimedia enhancements to interactive learning. ☐ ☐ Provides appropriate feedback: informative and timely. ☐ ☐ Motivates the learner to master concepts. ☐ ☐ The supplementary teaching materials contain strategies for integration with other content of disciplines (for example, English, Technology, and Art) into the instructional concept.

Teacher & Learner Support Materials	☐ ☐ Offers help at any stage. ☐ ☐ Provides various ways to reach technical support. ☐ ☐ Provides students with additional suitable resources such as web sites, bibliographies, etc. ☐ ☐ Easily track student's progress through feedback
Assessment methods	☐ ☐ Challenging. ☐ ☐ Appropriate. ☐ ☐ Suited to learning goals. ☐ ☐ Assess students' progress through evaluating the outcomes provided within the product
Age/Grade Appropriateness	☐ ☐ Reading level is appropriate for target audience. ☐ ☐ The content is appropriate for target audience. ☐ ☐ The product is suitable for the age and grade level. ☐ ☐ Directions are clear/ complete to perform required tasks. ☐ ☐ Mechanics of the program (instructions, response mode, feedback, and graphics) are appropriate for the target population. ☐ ☐ The product is suitable for different learning style.
Flexibility	☐ ☐ Learners can save at regular intervals and re-enter at any point ☐ ☐ The aspects of VM can be integrated into classroom activities. ☐ ☐ The students use it by themselves. ☐ ☐ The program could be used collaboratively. ☐ ☐ Provides multiple opportunities for hands-on experiences ☐ ☐ Provides information on educational activities to do at home.
integrating the Technology lab into everyday	☐ ☐ Integrates the use of technology for student skills development. ☐ ☐ Investigates of scientific ideas (websites, interactive text). ☐ ☐ Reflects the use of technology in real-life applications and careers. ☐ ☐ Includes activities that help students determine when to use tools. ☐ ☐ Include website support for teachers, families and students. ☐ ☐ Begin to use the lab outside of their scheduled computer class

	time. ☐ ☐ Begin to assign students independent research projects that require the Internet or an online encyclopedia, or library.
Computer skill's	☐ ☐ Help children to be independent researchers through the computer. ☐ ☐ Instruction which differentiated to each child's ability level. ☐ ☐ Children will be taught correct keyboarding and mouse skills. ☐ ☐ Children will practice presentation skills using PowerPoint. ☐ ☐ Children will be taught Internet skills and how to use the Internet as a research tool. ☐ ☐ Children will be taught basic word processing.
STS* programmed characterized the program give Children the opportunity to	☐ ☐ Identify local real life problems. ☐ ☐ Identify Local materials resource. ☐ ☐ Seek solutions of problems actively. ☐ ☐ Emphasis on process skills. ☐ ☐ Adopt decision-making roles. ☐ ☐ Emphasis cooperative learning. ☐ ☐ Build vocabulary on the topic. ☐ ☐ Build an understanding of the scientific processes involved in the topic. ☐ ☐ Build an understanding of the topic impact may have on society. ☐ ☐ Build an understanding of how the resources relevant to the topic are organized and accessed. ☐ ☐ Build an understanding of the social context in which the scientific work is done.

* STS: refer to `Science-Technology-Society.`

In your opinion, what are the major strengths of this program?

_____
_____
_____

In your opinion, what are the major weaknesses of this program?

_____
_____
_____

In your opinion, what is the overall quality of these instructional materials?

In your opinion, as informal environment could be successful affect of the class science and technology?

Comments Overall checklist

_____
_____
_____

Appendix (B.3)
رسالة إلى المشاركين " الخبراء"

أيها الأعزاء

تود الباحثة أن تقوم بهذه الدراسة كجزء من متطلبات الحصول على درجة الماجستير في أساليب التدريس في جامعة القدس. إن الهدف الرئيسي للدراسة هو تطوير المتحف الافتراضي لصفوف المرحلة الأساسية الدنيا كأداة لتعليم العلوم والتكنولوجيا في بيئة غير رسمية، وتريد الباحثة في الأساس أن تحظى بنظرة عميقة في نموذج المتحف الافتراضي من وجهة نظر المشاركين. سوف تتسلمون نموذجين (ألكتروني وكتيب)، ولديكم الخيار في الإجابة على أحدهما. تأمل الباحثة في أنكم ستجيبون على كل نقطة في نموذج التقييم بأمانة وبجدية. وتود الباحثة أن تطمئنكم بأن إجاباتكم ستبقى غاية في السرية، وستستخدم لأغراض البحث فقط.

وتقبلوا فائق الاحترام

الباحثة
بشرى البدوي

Appendix (B.4)
نموذج تقييم المتحف الافتراضي "للخبراء"

قامت الباحثة ببناء إستمارة التقييم قيد العرض بالرجوع الى العديد من المصادر. يرجى ملاحظة أنه كلما زاد عدد الفقرات المجابة بنعم فإن البرمجية التعليمية المقيمة ستكون على نحو أفضل، وعليه فإن الفقرات المجابة بلا تدلل على جملة القضايا التي تحتاج إلى النظر فيها. كما وتجدر الاشارة الى انه ينبغي استيفاء جميع متطلبات المحور قبل الشروع في المحور التالي.

القسم الاول

يرجى الإشارة إلى الخبرة في مجال التعليم الافتراضي عن طريق نقر واحد.

- **خبير في:**

العلوم التربوية أو أساليب التدريس.

موضوع المادة.

الوسائط المتعددة.

غير ذلك.

- **المؤهلات الأكاديمية** :

درجة الشهادة الجامعية الاولى.

الشهادة الجامعية الاولى ودرجة الدبلوم في التعليم.

درجة ماجستير.

درجة دكتوراه.

غير ذلك.

- **مستويات الخبرة :**

أقل من أربع سنوات.

من 4-7 سنوات.

أكثر من سبع سنوات

غير ذلك.

- **الأدوار المهنية :**

مدرس.

مدير.

أستاذ جامعي.

غير ذلك.

القسم الثاني:

من فضلك قم بالاجابة على الفقرات التالية بنعم أو لا.

المحور	نعم/لا	الفقرة
المحتوى والقيمة التربوية		دقيق.
		كامل.
		منظم تنظيما جيدا.
		تعرض بوضوح.
		مجدي.
		ذا صلة.
		القيمة التربوية واضحة.
		حقائق تأتي من مصادر موثوقة والتي حددت بشكل واضح.
		المحتوى والسياق يتفق مع هذا الموضوع.
		جميع المعلومات تتعلق بالغرض المعلن / أهداف التعلم.
		يشجع مستويات أعلى من التفكير.
		ويغطي مجموعة واسعة من المواضيع.
		يمكن الطلاب من تحقيق المفاهيم الهامة في عمق.
		اتصال ذات مغزى بين العلوم والمواد الأخرى، وكذلك لمواقف الحياة الفعلية.
		خالي من الأخطاء الإملائية، التصريف، النحو ،...، الخ.
الاتصال بالمنهاج		المعايير الوطنية يمكن الوصول إليها ويسهل ربطها مع التعليمات.
		الأهداف مصاغة بوضوح في المكان المخصص.
		أدلة واضحة للربط مع المنهاج الدراسي المستهدف.
		قائمة المعلومات والخبرات السابقة.
		استخدام أمثلة العالم الحقيقي لجعل التعليم ذات صلة.
		التوافق مع الارشادات المرتبطة بالموضع.
الرسومات / الوسائط المتعددة		الرسومات هي مصممة بشكل جيد.
		تقدم الرسومات لتعزيز التعلم.
		توافق الخلفية والنص.
		النص سهل القراءة.
		الرسومات متناسقة وملائمة وتهدف إلى تحسين التعلم.
		تستخدم الألوان بطريقة فعالة.

		الرسوم المتحركة دائما تكمل الموقف التعليمي. البرنامج المحوسب يستخدم الوسائط بشكل فعال (الصوت والرسومات، الفيديو). الوسائط المتعددة ذات صلة مباشرة بالهدف المعلن / الأهداف التعلمية.
العرض		واضح. عفوي. من السهل التنقل من خلال المعلومات للوصول الى المعالم الضرورية. متسلسل على نحو مناسب "منطقي". التوافق في كافة الصفحات.
الجوانب التقنية		الروابط تعمل بشكل مناسب. يعمل من خلال برامج التصفح الأكثر شيوعا جميع موارد الوسائط المتعددة تعمل بشكل ملائم. يمكن للمستخدمين الوصول إلى البرمجيات التعليمية بسهولة. يمكن للمستخدمين تثبيت البرامج بسهولة. التوجيهات المتاحة واضحة/ كاملة. العروضات على الشاشة مفهومة بسهولة. العروضات على الشاشة جذابة. الخروج من البرنامج سهل.
التكيف| سهولة التصفح		الفقرات والمباحث تتصدرها عناوين واضحة/ دقيقة. يتم استخدام خطوط واضحة باستمرار. يتناغم مع مختلف أنماط التعلم. يتناغم مع مختلف مستويات المتعلمين. الأنشطة والمناهج مناسبة لمواضيع محددة.
المشاركة / التفاعل		يتطلب المشاركة النشطة من المتعلم. النصوص توظف الوسائط المتعددة الفعالة لغرض التعلم التفاعلي. يوفر الرد المناسب: يغني بالمعلومات في الوقت المناسب. يحفز المتعلم لإتقان المفاهيم. المواد التعليمية المزودة تتضمن استراتيجيات للتكامل مع المحتويات الأخرى للتخصصات على سبيل المثال، اللغة الإنجليزية، والتكنولوجيا ، والفن) في المفهوم التعليمي.
مواد الدعم للمعلم والمتعلم		يقدم المساعدة في أي مرحلة. تؤمن طرق مختلفة للوصول إلى الدعم التقني. يزود الطلاب بالموارد الإضافية المناسبة مثل مواقع الويب والمراجع العلمية، الخ. يوفر التغذية الراجعة المؤدية الى تعقب تحسن الطالب بسهولة.

طرق التقييم		فيها تحدي. مناسبة. ملائمة لأهداف التعلم. تقييم تقدم الطلاب عن طريق تقييم النتائج المحققة عبر البرنامج.
ملاءمة الصف|العمر		مستوى القراءة مناسب للجمهور المستهدف. المحتوى يناسب الجمهور المستهدف. المنتج مناسب للعمر ومستوى الصف الدراسي. الاتجاهات واضحة / كاملة لأداء المهام المطلوبة. التصميم للبرنامج (تعليمات، نمط الاستجابة، التغذية الراجعة، والرسومات) مناسبة للفئة المستهدفة. المنتج التعليمي ملائم لمختلف أنماط التعلم.
المرونة		يمكن المتعلمين من حفظ ما تم انجازه الكترونيا على فترات منتظمة وإعادة الدخول عند أي لحظة. تتكامل جوانب التعلم الافتراضي مع النشاطات الصفية. يستخدمه الطلبة بأنفسهم. يستخدم البرنامج بشكل تعاوني. يوفر فرصا متعددة للخبرات اليدوية. يقدم معلومات عن الأنشطة التعليمية الواجب القيام بها في المنزل.
البرنامج توفر دمج مختبر التكنولوجيا في الحياة اليومية فهو		يدمج استخدام التكنولوجيا لتنمية المهارات الطلابية. يتحقق من الأفكار العلمية (المواقع الالكترونية والنصوص التفاعلية). يعكس استخدام التكنولوجيا في تطبيقات الحياة الواقعية والمهنية. يشتمل على الأنشطة التي تساعد الطلاب على تحديد وقت استخدام الأدوات. يشتمل على الموقع الداعم للعائلات والمعلمين والطلاب. البدء في استخدام المختبر خارج المواعيد المقرره لدروس الكمبيوتر. البدء بتعيين المشاريع البحثية المستقلة للطلبة والتي تتطلب الإنترنت أو الموسوعة على شبكة الإنترنت أوالمكتبة.
مهارات الحاسوب		مساعدة الأطفال ليكونوا باحثين مستقلين من خلال الكمبيوتر. تتمايز التعليمات لتتناسب مع مستوى اوقدرة كل طفل. سيمارس الأطفال التدريب على مهارات العرض من خلال برنامج البوربوينت. سيتعلم الأطفال ممارسة مهارات استخدام الشبكة الالكترونية وكيفية استخدام الانترنت كوسيلة للبحث. سيتعلم الأطفال مهارات استخدام الإنترنت وكيفية استخدام الانترنت كأداة للبحث.

		سيتعلم الأطفال المهارات الأساسية لمعالجة النصوص بإستخدام برنامج الوورد.
البرنامج يحقق معايير العلم، التكنولوجيا والمجتمع فهو يعطي الأطفال الفرصة ل		التعرف على مشاكل الحياة الواقعية في البيئة المحلية. التعرف على مصادر الموارد المحلية. البحث عن حلول للمشاكل بفاعلية. التركيز على عمليات المهارات. تبني أدوار صنع القرار. التركيزعلى التعلم التعاوني. بناء المفردات الخاصة بالموضوع. بناء الفهم المطلوب للعمليات العلمية التي ينطوي عليها الموضوع. بناء الفهم المطلوب للتأثيرالمحتمل للموضوع على المجتمع. بناء فهم لكيفية تنظيم والية االوصول للمصادر المرتبطة بالموضوع بناء فهم السياق الاجتماعي الذي تم بموجبه العمل العلمي.

من وجهة نظرك، ما هي نقاط القوة الرئيسية لهذا البرنامج؟

_____

_____

_____

من وجهة نظرك، ما هي نقاط الضعف الرئيسية لهذا البرنامج؟

_____

_____

_____

من وجهة نظرك، ما هي القيمة الاجمالية العليا لهذه المواد التعليمية؟

_____

من وجهة نظرك، هل يمكن للبيئة غير الرسمية أن تؤثر بنجاح في درس العلوم والتكنولوجيا؟

_____

_____

ملاحظات

_____

_____

Appendix (C.1)

Virtual Museum "VM" parent's Evaluation Form

Please note that the more items one can check off as "Yes" the better the software will be. Other items are issues that need to be considered. All requirements for a section should be met before the next section is attempted.

Please click one

- **Qualifications**
  - ☐ Lower than two-year diploma.
  - ☐ Diploma.
  - ☐ Upper than B.A.).
  - ☐ B.A.
  - ☐ Others.
- **Child's grade**…….
- **Child's class……..**

	Yes| No
General software quality evaluation	☐ ☐ Ease of initial use. ☐ ☐ High sound quality. ☐ ☐ High graphics quality. ☐ ☐ High video quality.
Appearance	☐ ☐ Text areas and graphic areas are balanced. ☐ ☐ The words on the slides are easy to read. ☐ ☐ The words on the slides are spelled correctly. ☐ ☐ The graphics on the slides are easy to see. ☐ ☐ The background compatible with the text or graphics. ☐ ☐ The colors and patterns are suitable. ☐ ☐ The slides seem to go together when moving from one page to another. ☐ ☐ Titles and headings are easily distinguished from other text. ☐ ☐ There is enough time to cover everything on each slide. ☐ ☐ Moving from one pages to another don't distract or bore the user.
Navigation	☐ ☐ Find the way easily. ☐ ☐ The navigation tools are easily seen.

	☐ ☐ The navigation tools lead to logical (expected) destinations. ☐ ☐ The navigation tools work probably. ☐ ☐ Users can turn off sound or music.
Content	☐ ☐ Accurate. ☐ ☐ Clear. ☐ ☐ Familiar. ☐ ☐ Appropriate. ☐ ☐ Well organized. ☐ ☐ Educational value is high. ☐ ☐ Easy to understand.
Enjoyable	☐ ☐ Keep your child interest all the time. ☐ ☐ Your child enjoyed the practical work. ☐ ☐ Your child enjoyed the tasks. ☐ ☐ Your child felt the ideas in this VM helped him to understand more about some everyday events and problems. ☐ ☐ Your child feels some of the things he/she learned in this VM would be useful at future. ☐ ☐ This VM makes your child more interesting in science.
Parent friendliness Truth in packaging	☐ ☐ Easy for you to help your child. ☐ ☐ Your expectations are achieved. If not, why?…… ☐ ☐ Child can use the software independently. ☐ ☐ Your child uses it while alone For how long? ……. ☐ ☐ Value to your child's education.
integrating the Technology lab into everyday	☐ ☐ Integrates the use of technology for your child skills development ☐ ☐ Investigation of scientific ideas (websites, interactive text). ☐ ☐ Reflects the use of technology in real-life applications and careers. ☐ ☐ Includes activities that help your child determine when to use tools. ☐ ☐ Include website support for your child. ☐ ☐ Begin to use the lab outside the computer class time. ☐ ☐ Begin to assign your child independent research projects that

	require the Internet or an online encyclopedia.
Computer skill's	☐ ☐ Helping your child to be independent researchers on the computer. ☐ ☐ Instruction which differentiated to each child's ability level. ☐ ☐ Teaching your child correct keyboarding and mouse skills. ☐ ☐ Your child practicing presentation skills using PowerPoint. ☐ ☐ Teaching your child Internet skills ☐ ☐ Teaching your child basic word processing.
STS* programmed characterized the program give Children the opportunity to	☐ ☐ Identify local real life problems. ☐ ☐ Identify Local resource materials. ☐ ☐ Seek solutions to problems actively. ☐ ☐ Emphasis on process skills. ☐ ☐ Adopt decision-making roles. ☐ ☐ Emphasis cooperative learning. ☐ ☐ Build vocabulary on the topic. ☐ ☐ Build an understanding of the scientific processes involved in the topic. ☐ ☐ Build an understanding of the topic impact may have on society. ☐ ☐ Build an understanding of how the resources relevant to the topic are organized and accessed. ☐ ☐ Build an understanding of the social context in which the scientific work is done.

* STS: refer to `Science-Technology-Society.`

Comments overall

……

Appendix (C.2)

رسالة إلى المشاركين الاباء

أيها الأعزاء

تود الباحثة أن تقوم بهذه الدراسة كجزء من متطلباتها لدرجة الماجستير في أساليب التعليم في جامعة القدس. إن الهدف الرئيسي للدراسة هو تطوير المتحف الافتراضي للصفوف الأساسية الأدنى كأداة لتعليم العلوم والتكنولوجيا في بيئة غير رسمية، وتريد الباحثة في الأساس أن تحظى بنظرة عميقة في نموذج المتحف الافتراضي من وجهة نظر المشاركين.
سوف تتسلمون نموذجين (ألكتروني وكتيب)، ولديكم الخيار في الإجابة على أحدهما.
تأمل الباحثة في أنكم ستجيبون على كل نقطة في نموذج التقييم بأمانة وبجدية. وتود الباحثة أن تطمئنكم بأن إجاباتكم ستبقى غاية في السرية، وستستخدم لأغراض البحث فقط.

وتقبلوا فائق الاحترام

الباحثة
بشرى البدوي

Appendix (C.3)

المتحف الافتراضي، نموذج تقييم أحد الوالدين
اعزائي الوالدين

أرجو ملاحظة أنه كلما زادت النقاط التي تم التأشير عليها على أنها صحيحة، كلما كان البرنامج أفضل. أما النقاط الأخرى فهي قضايا تحتاج للدراسة. ولا بد من تلبية كل متطلبات القسم قبل ألاجابة عن القسم التالي.
ستبقى المعلومات التالية سرية، لكنها ضرورية للمشروع .

الرجاء اختر واحدة من التالي:

- **المؤهلات**

أقل من دبلوم.
دبلوم.
بكالوريوس.
أعلى من بكالوريوس.
غيرذلك.

- **تقدير الطفل** .....
- **صف الطفل.....**

والان اجب بنعم أو لا في المكان المخصص.

المحور	نعم/لا	العباراة
تقييم عام لجودة البرنامج		سهولة الاستخدام الابتدائي.
		جودة صوت عالية.
		جودة صور عالية.
		جودة فيديو عالية.
المظهر		النصوص و الصور متوازنة
		الكلمات في الشرائح سهلة القراءة.
		الكلمات في الشرائح مكتوبة بشكل صحيح.
		الصور في الشرائح يمكن رؤيتها بسهولة.
		الخلفية متناغمة مع النص والصور.
		الألوان والأنماط ملائمة.
		تبدو الشرائح متوافقة عند الانتقال من صفحة إلى أخرى.
		من السهل تمييز العناوين الرئيسية والعناوين الفرعية من نص لآخر.
		هناك وقت كاف لتغطية كل شيء في كل شريحة.
		الانتقال من صفحة إلى أخرى لا يزعج أو يحير المستخدم.

التوجيه والقيادة		إيجاد الطريق بسهولة. تشاهد أدوات القيادة بسهولة. تقود أدوات القيادة إلى أهداف منطقية (متوقعة). تعمل أدوات التوجيه بشكل ملائم. يمكن للمستخدمين إيقاف الصوت أو الموسيقى.
المحتوى		دقيق. واضح. مألوف. ملائم. حسن التنظيم. القيمة التربوية عالية. سهل الفهم.
مدى التمتع		يحافظ على اهتمام طفلك طوال الوقت. استمتع طفلك بالنشاط العملي. استمتع طفلك بالنشاط النظري. ساعدت الأفكار الموجودة في هذا المتحف طفلك على فهم المزيد حول بعض الأحداث والمشاكل اليومية. بعض الأشياء التي تعلمها طفلك في هذا المتحف الافتراضي ستكون مفيدة في المستقبل. هذا المتحف الافتراضي يجعل طفلك أكثر اهتماما بالعلوم.
مدى السهولة والثقة في الرزمة		سهل لك أن تساعد طفلك. توقعاتك تتحقق. وإلا، فما السبب؟ .... يستطيع الطفل استخدام البرنامج بشكل مستقل. يستطيع طفلك يستخدم البرمجية وحيدا، ما طول الفترة؟..... قيمة بالنسبة لتعليم طفلك.
الرزمة توفر دمج مختبر التكنولوجيا في الحياة		تدمج استخدام التكنولوجيا لتنمية مهارات طفلكم. تحقق الأفكار العلمية في (مواقع ألكترونية، ونصوص تفاعلية). تعكس استخدام التكنولوجيا في المهن والتطبيقات في الحياة الحقيقية. تشمل النشاطات التي تساعد طفلك لتحديد وقت استخدام الأدوات. تشمل على مواقع الألكترونية مفيدة وداعمة لطفلكم.

اليومية فهي		تسمح بالبدء باستخدام المختبر خارج زمن حصة الحاسوب. تسمح بالبدء بتعيين مشاريع بحث مستقلة لطفلكم، والتي تتطلب هذه المشاريع الموسوعة الألكترونية أو المكتبة.
مهارات الحاسوب		تساعد طفلكم على أن يكون باحثا مستقلا في الحاسوب. التعليمات كانت متباينة حسب مستويات قدرات الطفل تعلم طفلكم المهارات الصحيحة لاستخدام لوحة المفاتيح والفأرة تدرب طفلكم على مهارات العرض باستخدام برنامج "بوربوينت". تعلم طفلكم مهارات الإنترنت. تعلم طفلكم مهارات برنامج معالجة النصوص.
البرنامج يحقق معايير العلم التكنولوجيا والمجتمع يعطي الأطفال الفرصة لـ		تحديد مشاكل واقع الحياة المحلية. تحديد مواد الموارد المحلية. البحث عن حلول للمشاكل بشكل فعال. التركيز على المهارات العملية. تبني أدوار صنع القرار. التأكيد على التعلم التعاوني. بناء المفردات حول الموضوع. بناء فهم للعمليات العلمية المتعلقة بالموضوع. بناء فهم حول إمكانية تأثير الموضوع على المجتمع. بناء فهم لكيفية تنظيم الموارد المرتبطة بالموضوع والوصول إليها. بناء فهم للسياق الاجتماعي الذي أنجز فيه العمل العلمي.

ملاحظات وتعليقات

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Appendix (D.1)

Virtual Museum "VM" Children Evaluation Form

Please note that the more items one can check off as "Yes" the better the software will be. Other items are issues that need to be considered. All requirements for a section should be met before the next section is attempted.
The following information will be kept confidential, but it is necessary for the project.

Grade-achievement…… **Class…..……**

	Yes|No
General software quality evaluation	☐ ☐ Ease of initial use. ☐ ☐ High sound quality. ☐ ☐ High graphics quality. ☐ ☐ High video quality.
Appearance	☐ ☐ Text areas and graphic areas are balanced. ☐ ☐ The words on the slides are easy to read. ☐ ☐ The words on the slides are spelled correctly. ☐ ☐ The graphics on the slides are easy to see. ☐ ☐ The background compatible with the text or graphics. ☐ ☐ The colors and patterns are suitable. ☐ ☐ The slides seem to go together when moving from one page to another. ☐ ☐ Titles and headings are easily distinguished from other text. ☐ ☐ There is enough time to cover everything on each slide. ☐ ☐ Moving from one pages to another do not distract or bore you.
Navigation	☐ ☐ Find the way easily. ☐ ☐ The navigation tools are easily seen. ☐ ☐ The navigation tools lead to logical (expected) destinations. ☐ ☐ The navigation tools work probably. ☐ ☐ Users can turn off sound or music.
Content	☐ ☐ Accurate. ☐ ☐ Clear. ☐ ☐ Familiar.

	☐ ☐ Appropriate. ☐ ☐ Well organized. ☐ ☐ Educational value is high. ☐ ☐ Easy to understand.
Enjoyable	☐ ☐ Keep your interest over time. ☐ ☐ You enjoyed the practical work ☐ ☐ You enjoyed the theoretical work ☐ ☐ The ideas in this VM helped you to understand more about some everyday events and problems. ☐ ☐ Some things you learned in this VM would be useful at future. ☐ ☐ This VM makes you more interesting in science.
integrating the Technology lab into everyday	☐ ☐ Integrates the use of technology for your skills development. ☐ ☐ Investigation of scientific ideas (websites, interactive text) ☐ ☐ Reflects the use of technology in real-life applications and careers. ☐ ☐ Includes activities that help students determine when to use tools. ☐ ☐ Include website support for you. ☐ ☐ Begin to use the lab outside the computer class time. ☐ ☐ Begin to assign you independent research projects that require the Internet or an online encyclopedia, and library.
Computer skill's	☐ ☐ Helping you to be independent researchers on the computer. ☐ ☐ Instruction which differentiated to each kid's ability level. ☐ ☐ Teaching you correct keyboarding and mouse skills. ☐ ☐ Practicing you presentation skills using PowerPoint. ☐ ☐ Teaching you Internet skills ☐ ☐ Teaching you basic word processing.
STS* programmed characterized. the program gives Children the opportunity to	☐ ☐ Identify local real life problems. ☐ ☐ Identify Local resource materials. ☐ ☐ Seek solutions to problems actively. ☐ ☐ Emphasis on process skills. ☐ ☐ Adopt decision-making roles. ☐ ☐ Emphasis cooperative learning.

	☐ ☐ Build vocabulary on the topic. ☐ ☐ Build an understanding of the scientific processes involved in the topic. ☐ ☐ Build an understanding of the topic impact may have on society. ☐ ☐ Build an understanding of how the resources relevant to the topic are organized and accessed. ☐ ☐ Build an understanding of the social context in which the scientific work is done.

* STS: refer to `Science-Technology-Society.`

Comments……
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Appendix (D.2)

المتحف الافتراضي، نموذج تقييم من قبل الأطفال

اعزائي الاطفال عليكم ملاحظة أنه كلما زادت النقاط التي سيتم التأشير عليها على أنها صحيحة، كلما كان البرنامج أفضل. أما النقاط الأخرى فهي قضايا تحتاج للدراسة. ولا بد من تلبية كل متطلبات القسم قبل تجربة القسم التالي.

ستبقى المعلومات التالية سرية، لكنها ضرورية للمشروع.

التقدير..... الصف.....

المحور	نعم/لا	الفقرة
تقييم عام لجودة البرنامج		سهولة الاستخدام الابتدائي. جودة صوت عالية. جودة صور عالية. جودة فيديو عالية..
المظهر		النصوص و الصور متوازنة الكلمات في الشرائح سهلة القراءة. الكلمات في الشرائح مكتوبة بشكل صحيح. الصور في الشرائح يمكن رؤيتها بسهولة. الخلفية متناغمة مع النص والصور. الألوان والأنماط ملائمة. تبدو الشرائح متوافقة عند الانتقال من صفحة إلى أخرى. من السهل تمييز العناوين الرئيسية والعناوين الفرعية من نص آخر. هناك وقت كاف لتغطية كل شيء في كل شريحة. الانتقال من صفحة إلى أخرى لا يزعج أو يحير المستخدم.
التوجيه والقيادة		إيجاد الطريق بسهولة. تشاهد أدوات القيادة بسهولة. تقود أدوات القيادة إلى أهداف منطقية (متوقعة). تعمل أدوات التوجيه بشكل ملائم. يمكنك إيقاف الصوت أو الموسيقى.

المحتوى		دقيق. واضح. مألوف. ملائم. حسن التنظيم. القيمة التربوية عالية. سهل الفهم.
ممتع		حافظ على اهتمامكم طوال الوقت. استمتعتم بالنشاط العملي. استمتعم بالنشاط النظري " المهام". تساعدكم الأفكار في هذا المتحف الافتراضي على الفهم أكثر حول بعض الأحداث والمشاكل اليومية. ستكون بعض الأشياء التي تعلمتها في هذا المتحف الافتراضي مفيدة في المستقبل. يجعلكم هذا المتحف الافتراضي مهتمين أكثر في العلوم.
دمج مختبر التكنولوجيا في الحياة اليومية		دمج استخدام التكنولوجيا لتطوير مهاراتكم. بحث الأفكار العلمية (مواقع ألكترونية، ونصوص تفاعلي). تعكس استخدام التكنولوجيا في المهن والتطبيقات في الحياة الحقيقية. تشمل النشاطات التي تساعد الطلبة لتحديد وقت استخدام الأدوات. تشمل الدعم الذي يقدمه الموقع الألكتروني لكم. البدء باستخدام المختبر خارج زمن حصة الحاسوب. البدء بتعيين مشاريع بحث مستقلة لكم، والتي تتطلب هذه المشاريع الموسوعة الألكترونية أو المكتبة.
مهارات الحاسوب		تساعدكم على أن تكونوا باحثيين مستقلين في الحاسوب. تعليمات من شأنها أن تميز مستوى قدرة كل طفل. تعلمكم المهارات الصحيحة لاستخدام لوحة المفاتيح والفأرة. تدربكم على مهارات إلقاء المحاضرات باستخدام برنامج "بوربوينت". تعلمكم مهارات الإنترنت. تعلمكم مهارات برنامج معالجة النصوص.
البرنامج يحقق معايير العلم والتكنولوجيا والمجتمع يعطي		تحديد مشاكل واقع الحياة المحلية. تحديد اهتماماتك الشخصية. تحديد مواد الموارد المحلية. البحث عن حلول للمشاكل بشكل فعال.

الأطفال الفرصة لـ		التركيز على المهارات العملية. تبني أدوار صنع القرار. التأكيد على التعلم التعاوني. بناء المفردات حول الموضوع. بناء فهم للعمليات العلمية المتعلقة بالموضوع. بناء فهم حول إمكانية تأثير الموضوع على المجتمع. بناء فهم لكيفية تنظيم الموارد المرتبطة بالموضوع والوصول إليها. بناء فهم للسياق الاجتماعي الذي أنجز فيه العمل العلمي.

تعليقات

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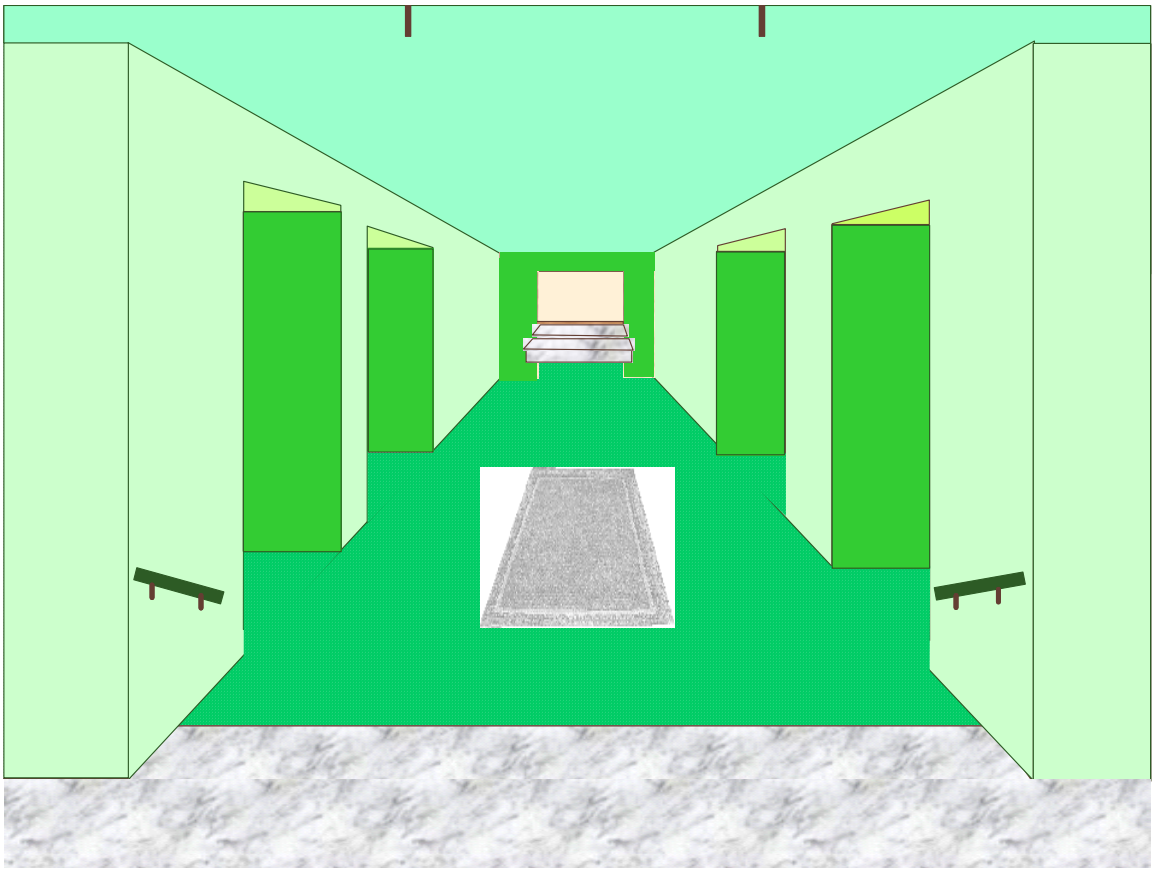
Appendix (E)

The name of the adjudication committee.

Name	Qualification	Years of experiences	Field of experience
Dr. Abdellhamid Zeer	PhD	More than seven years	E-learning
Mr. Awni Jaber	MSc.	More than seven years	Pedagogical \ computer science
Dr. Buad Alkhalis	PhD	More than seven years	Pedagogical\ early childhood
Dr. Ibraheem Arman	PhD	More than seven years	Pedagogical\ computer science
Dr. Kamel Hashim	PhD	More than seven years	Pedagogical \ computer science
Eng. Maysoon Abou Shanab	MSc.	More than seven years	Computer Engineer
Dr Mohsen Adas	PhD	More than seven years	Pedagogical\ E-learning
Dr. Rasheed Aljayousi	PhD	More than seven years	Computer science\ E-learning
Mr. Jihad Hijazi	B.A	More than seven years	Science teacher

Appendix (F)

VM structure



Appendix (G)

Experts the frequency and percentage for each items in the domain:

	Count %	No	Yes
A1. Content & Educational Value			
Accurate	Count		18
	%		100.0%
Complete	Count	7	11
	%	38.9%	61.1%
Well organized.	Count		18
	%		100.0%
Presented clearly.	Count		18
	%		100.0%
Meaningful	Count		18
	%		100.0%
Relevant.	Count		18
	%		100.0%
Has obvious educational value.	Count	2	16
	%	11.1%	88.9%
Facts come from reliable sources which are clearly identified.	Count	1	17
	%	5.6%	94.4%
Content and context are consistent with the theme.	Count	1	17
	%	5.6%	94.4%
All information relates to the stated purpose / learning goals.	Count		18
	%		100.0%
Encourages higher levels of thinking.	Count	2	16
	%	11.1%	88.9%
A broad range of topics is covered.	Count	4	14
	%	22.2%	77.8%
Enables students to investigate important concepts in depth.	Count		18
	%		100.0%
Makes meaningful connections between science and other content areas as well as to real-life situations.	Count		18
	%		100.0%
Free of errors in grammar, spelling, usage, etc.	Count	1	17
	%	5.6%	94.4%
A2. Curriculum Connections			
National standards are accessible with easily linked to instruction.	Count	4	9
	%	30.8%	69.2%
Objectives are clearly stated on Entry Form	Count	1	14
	%	6.7%	93.3%
Clear evidence of connection to target curriculum	Count	1	12
	%	7.7%	92.3%
List prerequisite skills.	Count	1	14
	%	6.7%	93.3%

Use real world examples to make the instruction relevant.	Count	2	12
	%	14.3%	85.7%
Complies with subject based guidelines	Count	3	12
	%	20.0%	80.0%
A3. Graphics/ Multimedia			
Graphics are well designed	Count	3	15
	%	16.7%	83.3%
Graphics are rendered to enhance learning	Count		18
	%		100.0%
Background and text are compatible	Count		17
	%		100.0%
Text is easy to read	Count	1	17
	%	5.6%	94.4%
Graphics are consistent, appropriate designed to optimize learning	Count	3	14
	%	17.6%	82.4%
Colors are used in an effective way	Count		18
	%		100.0%
Animation always complements learning.	Count	1	17
	%	5.6%	94.4%
The software uses media effectively (audio, graphics, video).	Count	1	16
	%	5.9%	94.1%
Multimedia directly related to stated purpose /learning goals.	Count		17
	%		100.0%
A4. Lay-out			
Clear.	Count		17
	%		100.0%
Spontaneous.	Count	4	13
	%	23.5%	76.5%
Easy to navigate through the information to find necessary features.	Count		17
	%		100.0%
Appropriately sequenced “logical”.	Count		16
	%		100.0%
Consistent on all pages.	Count	1	16
	%	5.9%	94.1%
A5. Technical Aspects			
Links work suitably.	Count		18
	%		100.0%
Possible to work in most common browsers	Count	1	15
	%	6.3%	93.8%
All multimedia resources work properly.	Count	1	17
	%	5.6%	94.4%
Users are able to access software easily.	Count	1	15
	%	6.3%	93.8%
Users are able to install software easily.	Count	4	13
	%	23.5%	76.5%

Clear/ complete directions are available for access.	Count	1	15
	%	6.3%	93.8%
The screen displays are easily understood	Count		18
	%		100.0%
The screen displays are attractive.	Count	4	14
	%	22.2%	77.8%
Exiting the program is easy.	Count		18
	%		100.0%
A6. Adaptability/ Accessibility	Count		
	%		
Paragraphs and sections have clear/ accurate informative headings.	Count		16
	%		100.0%
Clear fonts are used consistently.	Count	2	14
	%	12.5%	87.5%
Accommodates various learning styles.	Count	2	14
	%	12.5%	87.5%
Accommodates various ability levels.	Count	4	12
	%	25.0%	75.0%
Activities and approaches are appropriate for specific topics.	Count	1	15
	%	6.3%	93.8%
A7. Engagement/ Interactivity	Count		
	%		
Requires learners to become actively engaged in order to learn.	Count	1	15
	%	6.3%	93.8%
Text employs multimedia enhancements to interactive learning.	Count		17
	%		100.0%
Provides appropriate feedback: informative and timely.	Count	3	14
	%	17.6%	82.4%
Motivates the learner to master concepts.	Count	1	16
	%	5.9%	94.1%
The supplementary teaching materials contain strategies for integration with other content of disciplines (for example, English, Technology, and Art) into the instructional concept.	Count	1	16
	%	5.9%	94.1%
A8. Teacher & Learner Support Materials			
Offers help at any stage.	Count	6	12
	%	33.3%	66.7%
Provides various ways to reach technical support.	Count	7	11
	%	38.9%	61.1%
Provides students with additional suitable resources such as web sites, bibliographies, etc.	Count		18
	%		100.0%
Easily track student's progress through feedback	Count	2	16
	%	11.1%	88.9%
A9. Assessment methods	Count		
	%		

Challenging.	Count	1	17
	%	5.6%	94.4%
Appropriate.	Count		18
	%		100.0%
Suited to learning goals.	Count	2	16
	%	11.1%	88.9%
Assess students' progress through evaluating the outcomes provided within the product	Count	6	11
	%	35.3%	64.7%
A10.Age/Grade Appropriateness	Count		
	%		
Reading level is appropriate for target audience.	Count	1	16
	%	5.9%	94.1%
The content is appropriate for target audience.	Count	1	17
	%	5.6%	94.4%
The product is suitable for the age and grade level.	Count		18
	%		100.0%
Directions are clear/ complete to perform required tasks.	Count	1	17
	%	5.6%	94.4%
Mechanics of the program (instructions, response mode, feedback, and graphics) are appropriate for the target population.	Count		18
	%		100.0%
The product is suitable for different learning style.	Count	1	17
	%	5.6%	94.4%
A11. Flexibility	Count		
	%		
Learners can save at regular intervals and re-enter at any point	Count	10	6
	%	62.5%	37.5%
The aspects of VM can be integrated into classroom activities.	Count	1	16
	%	5.9%	94.1%
The students use it by themselves.	Count		17
	%		100.0%
The program could be used collaboratively.	Count	3	13
	%	18.8%	81.3%
Provides multiple opportunities for hands-on experiences	Count	1	17
	%	5.6%	94.4%
Provides information on educational activities to do at home.	Count		18
	%		100.0%
A12.Integrating the Technology lab into everyday			
Integrates the use of technology for student skills development.	Count		18
	%		100.0%
Investigates of scientific ideas (websites, interactive text).	Count		18
	%		100.0%
Reflects the use of technology in real-life applications and careers.	Count	4	14
	%	22.2%	77.8%
Includes activities that help students determine when to use tools.	Count	4	14

	%	22.2%	77.8%
Include website support for teachers, families and students.	Count		18
	%		100.0%
Begin to use the lab outside of their scheduled computer class time.	Count	1	17
	%	5.6%	94.4%
Begin to assign students independent research projects that require the Internet or an online encyclopedia, or library.	Count		16
	%		100.0%
A13. Computer skill's			
Help children to be independent researchers through the computer.	Count	3	14
	%	17.6%	82.4%
Instruction which differentiated to each child's ability level.	Count	3	13
	%	18.8%	81.3%
Children will be taught correct keyboarding and mouse skills.	Count	2	15
	%	11.8%	88.2%
Children will practice presentation skills using PowerPoint.	Count	4	13
	%	23.5%	76.5%
Children will be taught Internet skills and how to use the Internet as a research tool.	Count	2	15
	%	11.8%	88.2%
Children will be taught basic word processing.	Count	2	15
	%	11.8%	88.2%
A14. STS* programmed characterized			
Identify local real life problems.	Count	8	10
	%	44.4%	55.6%
Identify Local materials resource.	Count	3	15
	%	16.7%	83.3%
Seek solutions of problems actively.	Count	2	16
	%	11.1%	88.9%
Emphasis on process skills.	Count	4	14
	%	22.2%	77.8%
Adopt decision-making roles.	Count	7	10
	%	41.2%	58.8%
Emphasis? cooperative learning.	Count	4	13
	%	23.5%	76.5%
Build vocabulary on the topic.	Count	3	14
	%	17.6%	82.4%
Build an understanding of the scientific processes involved in the topic.	Count	2	15
	%	11.8%	88.2%
Build an understanding of the topic impact may have on society.	Count	3	13
	%	18.8%	81.3%
Build an understanding of how the resources relevant to the topic are organized and accessed.	Count	2	15
	%	11.8%	88.2%
Build an understanding of the social context in which the scientific work is done.	Count	2	15
	%	11.8%	88.2%

Appendix (H.1)

Preliminary field test experts.

Name	Qualification	Years of experiences	Experience in
Dr. Abdellhamid Alzeer	PhD	More than seven years	E-learning
Mr. Ali Salim Eriqat	MSc.	More than seven years	Multimedia
Mr. Awni Jaber	PhD	More than seven years	Pedagogical \ Computer science
Dr Akram qaroubi	PhD	More than seven years	E-learning
Dr. Buad Alkhalis	PhD	More than seven years	Pedagogical\ early childhood
Dr. Ibraheem AlGrouz	MSc.	More than seven years	E-learning
Mr. Jihad Hijazi	PhD	More than seven years	Subject matter\ pedagogical
Dr. Kamel Hashim	PhD	More than seven years	Pedagogical \ Computer science
Eng. Maysoon Abou Shanab	MSc.	More than seven years	Computer Engineer
Dr. Mohsen Adas	PhD	More than seven years	Pedagogical\ e-learning
Eng. Noura Halabiya	B.A	More than seven years	Pedagogical\ Computer Engineer
Abeer Alhag	MSc.	More than seven years	Multimedia
Jihad Hijazi	B.A	More than seven years	Subject matter
Mahmoud Alheeh	B.A	More than seven years	Multi Media
Naser Anani	B.A	More than four years	Subject Matter
Nisreen Doufish	B.A	More than four years	Subject Matter
Amnih Edees	B.A	More than four years	Subject Matter
Shareefa Hijazi	B.A	More than seven years	Subject Matter

Appendix (H.2)

Preliminary field test format-specific responses.

Expert Comment	Research Action	Type of experts and its properties
Content & Educational Value		
I think the content is presented fairly logically. The content is clear. The content is appropriate. The content is simple.	Acknowledged.	Pedagogical over7 years 2 of them university teacher, PhD. 2 school teacher, BA
Curriculum Connections		
Graphics/ Multimedia		
I found the text in the VM easy to read and it is clear and concise. I do not have comments other than keep up the Good work when you make changes! The graphics is appropriate. The graphics and the text well designed. The graphics is suitable.	Acknowledged.	Pedagogical over than 7years, ST, MA. MM, over than 7 years, UT, PhD
"The screen displays are attractive". You might want to mention more colors in the user interface screen.	Agreed. More colors were added to the user interface screen.	Pedagogical, PhD, UT, over 7years.
Technical Aspects		
I'm not sure "links work suitably" are, but if you are talking about the different sections like "experiment at home", "history of science" ….or "technology of science" then yes, I think they were helpful, but occasionally I found them distracting as I read through the text. Again, I think this is a limitation of the browse page, where some of these components would work better as sidebars online. اوصي بحاجه ربط البرمجيه مع الشبكه العالميه ليكون عالمي وليست محلي فقط.	Agreed. The researcher agree that the browse page format is limiting and hope that the VM will eventually be available in an online WEB. This will become as a recommendation for improving the VM Website, not the	Multimedia, MA, UT, over 7years,

	VM software.	Pedagogical, PhD, UT, over 7years.
Adaptability/ Accessibility		
Engagement/ Interactivity		
More games are required for this age.	Agreed future step.	Multimedia, PhD,UT, over7years.
Teacher & Learner Support Materials		
Assessment methods		
• There is no overall evaluation for exercises (how many rights and wrongs). Most evaluation is related to information, not skills. There is no interaction between teacher & student if the activities are done at home. There is no record of the evaluation when the student do the exercises. Grades are not saved for the attempts • They were fun assignments. Should have been more of them. • They were fun worksheets. • They were interesting worksheets. • أفكار مستقبليه منح الطالب أمكانية تسليم أوراق العمل بشكل الكتروني.		Multimedia, PhD, UT, over7years. Subject matter, BA,ST, over than 7years Subject matter, BA,ST,over 7yearsr to seven years. BA,ST, over than seven years. Multi media, MA, UT, over than 7years.
Age/Grade Appropriateness		
Flexibility		
Why Learners cant save at regular intervals and re-enter at any point	Agree the researcher put this point in her mind for the future development stage	Multimedia, MA,UT, over 7years
Integrating the Technology lab into everyday		
Computer skill's		
STS* programmed characterized the program give Children the opportunity to		
In your opinion, what are the major		

strengths of this program?		
• It's encouraged the children to study, it give them untraditional way to learn. • Provides additional activities and links to external websites. The program is easy to use. Allow to read, write, watch and hear. • It is outstanding in terms of introducing e-learning to this level. Too much effort is spent to collect materials in Arabic. • The major strength of this program that it builds some skills and thinking for the users of this system and gives them the opportunity to cooperate with each others. • The material in Arabic which is good. • It's good as an interactive program. • The effective use of educational technology in stimulating and encouragement of the self-learning approach from the early ages of students. • Content and evaluation, the useful link. • I like the idea about links to other museums and educational resources. • برنامج تفاعلي.يوائم أنماط تعلم مختلفه السماع، المشاهدة، الكتابة، العمل. المادة العربية بحد ذاتها في موضوع مثل العلوم رائع جداً. • يعالج امور العلم والتكنولوجيا والمجتمع، بالاضافه الى المجالات المعرفيه الاخرى. • يتيح للطالب فرصة القراءة والمشاهدة والعمل. • يعطي الطفل فرصة الانفتاح الى المعرفه ينمي	Acknowledgment	Subject matter, BA, ST, over7years. Multimedia, PhD, UT, over 7years. Multimedia, PhD, UT, over 7years. Pedagogical, MA, UT, over than 7years Subject matter, BA, ST, less than 4 years. Multimedia, PhD., UT, over 7years. MM, MS, UT, over 7years. pedagogical, MA, ST, over 7years. SM, BA,ST, between 4 and 7. Pedagogical, PhD, UT, over seven years. SM, BA, ST, over 7 years. Pedagogical, PhD, UT,

حب الاستطلاع والاكتشاف ويطور مهارات التفكير العلمي. • الرسومات/ الألوان/ طريقة العرض. • المادة العلمية (المحتوى) مألوف لدى الطلاب • سهولة التعامل معه من حيث الخروج والدخول للفعاليات. • استخدام الرسوم والألوان لطرح المعلومات، وهذا يلفت نظر الطلبه. • الرسومات المستخدمه/ استخدام الحاسوب، المواقع المفيدة.		over 7years. SM, BA,ST, over 7years SM,BA,ST, over 7years. SM, BA, ST, less 4 years. SM, BA, ST, between 4 and 7
In your opinion, what are the major weaknesses of this program?		
• The ability to keep the content timely and current. • Need more virtual laps. • Materials provided for evaluating higher skills are limited. • It needs more animations for some of the contents. • It's very limited for some subjects. • The wide range of the target group ages is expected to require a different consideration and contents in the suggested program. • تطوير مقدرة الطفل على التفكير	Disagreed. The "VM" in database has the ability to keep the content timely and current. Agreed the researcher design more for other concept like the heart, circuit electric, and she will design more in the future. Agreed future steps. Agree future steps. Disagreed, the researcher took five concept with depth and interdesplinery with other subject, the idea is	MM, Ph.D., UT, over7 years MM, Ph.D., UT, over7 years MM, Ph.D., UT, over7 years Pedagogical, phd,ut.over7 MM, Ph.D., UT, over7 years MM, Ph.D., UT, over7 years

الخلاق وانتاج معرفة جديدة. • بعض المعلومات أعلى من مستوى الطالب، مثلاً أسماء بعض الحيوانات يأخذها الطالب. باللغه الأنجليزيه لم • لا يوجد.	flexible for expanded to another concepts and other subject. Disagreed as weaknesses of this program, because the researcher taken this point in her priority "different consideration and different content" for different level from first grade to fourth grade. Agreed for future steps in this phase STS. Disagreed, let him took information that is upper from their age.	pedagogical, Ph.D., UT, over7 years SM, BA, ST, over 7years.
In your opinion, what is the overall quality of these instructional materials?		
I highly recommended it as an outstanding attempt to change the way we present science to our children. Excellent. Helps users of self learning and self dependent. Over all quality from multi media view point is good. The comprehensive use of teaching	Acknowledgment. Acknowledgment. Acknowledgment. Acknowledgment.	MM, Ph.D, UT, OVER 7YEARS SM, BA, ST, BETWEEN 4 AND 7YEARS MM, Ph.D, UT, OVER 7YEARS. MM, Ph.D, UT, OVER 7YEARS

and learning technologies as an effective and attractive presentation of the elementary grades curriculum. استخدام الحاسوب/ تعويد الطالب على الدراسة المحوسبه.	Acknowledgment.	MM, Ph.D, UT, OVER 7YEARS SM,BA, ST, OVER THAN 7YEARS
In your opinion, as informal environment could be successful affect of the class science and technology?		
• Yes it could be. • I think it is yes. • Yes, I believe so. • أتوقع أن يكون له تأثيرا في تعلم الطلبة العلوم والتكنولوجيا في. • نعم ممكن أن تؤثر بنجاح وبشكل كبير. • لا • I like the idea about links to other museums and educational resources, it could be as source for linking class in informal environment. • Yes, by providing further interactions between student and the concepts throw different situations.	Agreed	MM, Ph.D., UT, over 7 years. SM, BA.,ST, over 7 years. Pedagogical, Ph.D, UT. Over 7years. Peda, MA, ST, over 7years, SM, BA, ST, over 7 years. Pedagogical, Ph.D,UT, over 7 years. pedagogical, Ph.D, UT, over 7.
checklist Overall Comments		
• I think that the program is comprehensive, satisfaction, and clear. • Good, go ahead. • The project is outstanding in terms of effort spent to put together the material. • Sound should be introduced not just labels for headings. The child should hear “Animals” for eg. Not just read the label “Animals”. • More multimedia design of the front page.	Acknowledgment. Acknowledgment.	Pedagogical, MA, UT, over 7years. MM, Ph.d.,UT, over 7years MM, Ph.d.,UT, over 7years. MM, Ph.d.,UT, over 7years

• More multimedia design of the front page. • It is too classic for children, some pictures required. There is a new technology (real life) that could have been used to enter a real museum virtually and do all these activities. • This is an excellent tool for children to access information and self-assessment. • There is no problem-solving assessment that the teacher look at what the student did at home and interact with that student, in this case the parents have to sit with their children for external assessment or this is done in class where the teacher has to follow each student. But this is not the reason why this project is done, the student may learn at home by games and movies,… in this case the VM does not provide teacher assessment… it is just self assessment. Thank you for this work. It should open the door and open our eyes. • The work sounds to be very promising, hope fully you will successfully check its empirical effect practically. • افكار مستقبية: امكانية دمج هذا النظام مع أنظمة إدارة المساقات الالكترونية Moodle. • فكري بدمج الخيال العلمي في هذا السياق. مع كل هذة الملاحظات الا أنك قمت بجهد موفق واثمن لك جهودك.	Agreed, the researcher took this point in her priority for future steps. Acknowledgment.	MM, Ph.d.,UT, over 7years Pedagogical,phd,ut,over 7years MM, Ph.d.,UT, over 7years MM, Ph.d.,UT, over 7years MM, Ph.d.,UT, over 7years MM, Ph.d.,UT, over 7years MM,MA.,UT, over 7years pedagogical, Ph.d.,UT, over 7years

• هذا البرنامج يلفت الى أهمية استخدام الحاسوب في التعليم، ونرجو أن يعمم هذا البرنامج على المواد الأخرى ليكون وسيله تعليميه في مدارسنا. • So far so بشكل عام العمل جيد good.	Agreed for future steps. Acknowledgment.	SM, BA, ST, less than 4years. Pedagogical, Phd, UT, over 7 years.

Appendix (I)

Parents the frequency and percentage for each items in the domain:

		No	Yes
General software quality evaluation	Count		
	%		
Ease of initial use.	Count	3	9
	%	25.0%	75.0%
High sound quality.	Count	3	9
	%	25.0%	75.0%
High graphics quality.	Count		12
	%		100.0%
High video quality.	Count	2	10
	%	16.7%	83.3%
Appearance			
Text areas and graphic areas are balanced.	Count	1	11
	%	8.3%	91.7%
The words on the slides are easy to read.	Count	1	11
	%	8.3%	91.7%
The words on the slides are spelled correctly.	Count	2	10
	%	16.7%	83.3%
The graphics on the slides are easy to see.	Count	2	10
	%	16.7%	83.3%
The background compatible with the text or graphics.	Count	2	10
	%	16.7%	83.3%
The colors and patterns are suitable.	Count	2	10
	%	16.7%	83.3%
The slides seem to go together when moving from one page to another.	Count	2	10
	%	16.7%	83.3%
Titles and headings are easily distinguished from other text.	Count	3	9
	%	25.0%	75.0%
There is enough time to cover everything on each slide.	Count		12
	%		100.0%
Moving from one pages to another don't distract or bore the user.	Count	2	10
	%	16.7%	83.3%
Navigation			
Find the way easily.	Count	3	9
	%	25.0%	75.0%
The navigation tools are easily seen.	Count	3	9
	%	25.0%	75.0%
The navigation tools lead to logical (expected) destinations.	Count	1	11
	%	8.3%	91.7%
The navigation tools work probably.	Count	3	9
	%	25.0%	75.0%
Users can turn off sound or music.	Count	2	10
	%	16.7%	83.3%

Appendix (J)

Children the frequency and percentage for each items in the domain:

		No	Yes
General software quality evaluation			
Ease of initial use.	Count	5	95
	%	5.0%	95.0%
High sound quality.	Count	10	83
	%	10.8%	89.2%
High graphics quality.	Count	1	99
	%	1.0%	99.0%
High video quality.	Count	8	82
	%	8.9%	91.1%
Appearance			
Text areas and graphic areas are balanced.	Count	10	90
	%	10.0%	90.0%
The words on the slides are easy to read.	Count	10	90
	%	10.0%	90.0%
The words on the slides are spelled correctly.	Count	8	88
	%	8.3%	91.7%
The graphics on the slides are easy to see.	Count	9	91
	%	9.0%	91.0%
The background compatible with the text or graphics.	Count	4	95
	%	4.0%	96.0%
The colors and patterns are suitable.	Count	3	97
	%	3.0%	97.0%
The slides seem to go together when moving from one page to another.	Count	21	79
	%	21.0%	79.0%
Titles and headings are easily distinguished from other text.	Count	7	93
	%	7.0%	93.0%
There is enough time to cover everything on each slide.	Count		100
	%		100.0%
Moving from one pages to another don't distract or bore the user.	Count	19	81
	%	19.0%	81.0%
Navigation			
Find the way easily.	Count	9	90
	%	9.1%	90.9%
The navigation tools are easily seen.	Count	10	89
	%	10.1%	89.9%
The navigation tools lead to logical (expected) destinations.	Count	9	90
	%	9.1%	90.9%
The navigation tools work probably.	Count	10	89
	%	10.1%	89.9%
Users can turn off sound or music.	Count	5	94
	%	5.1%	94.9%
Content			

Accurate.	Count		99
	%		100.0%
Clear.	Count	1	99
	%	1.0%	99.0%
Familiar.	Count	5	95
	%	5.0%	95.0%
Appropriate.	Count	1	99
	%	1.0%	99.0%
Well organized.	Count	2	98
	%	2.0%	98.0%
Educational value is high.	Count	3	97
	%	3.0%	97.0%
Easy to understand.	Count	2	98
	%	2.0%	98.0%
Enjoyable	Count		
	%		
Keep your child interest all the time.	Count	6	94
	%	6.0%	94.0%
Your child enjoyed the practical work.	Count		100
	%		100.0%
Your child enjoyed the tasks.	Count	12	88
	%	12.0%	88.0%
Your child felt the ideas in this VM helped him to understand more about some everyday events and problems.	Count	9	91
	%	9.0%	91.0%
Your child feels some of the things he/she learned in this VM would be useful at future.	Count		100
	%		100.0%
This VM make your child more interesting in science.	Count	1	99
	%	1.0%	99.0%
Integrating the Technology lab into everyday			
Integrates the use of technology for student skills development.	Count	1	98
	%	1.0%	99.0%
Investigates of scientific ideas (websites, interactive text).	Count	1	96
	%	1.0%	99.0%
Reflects the use of technology in real-life applications and careers.	Count	6	93
	%	6.1%	93.9%
Includes activities that help students determine when to use tools.	Count	4	95
	%	4.0%	96.0%
Include website support for teachers, families and students.	Count	29	69
	%	29.6%	70.4%
Begin to use the lab outside of their scheduled computer class time.	Count		99
	%		100.0%
Begin to assign students independent research projects that require the Internet or an online encyclopedia, or library.	Count	3	96
	%	3.0%	97.0%
Computer skill's			

Help children to be independent researchers through the computer.	Count	3	96
	%	3.0%	97.0%
Instruction which differentiated to each child's ability level.	Count	7	92
	%	7.1%	92.9%
Children will be taught correct keyboarding and mouse skills.	Count		99
	%		100.0%
Children will practice presentation skills using PowerPoint.	Count	2	97
	%	2.0%	98.0%
Children will be taught Internet skills and how to use the Internet as a research tool.	Count	32	66
	%	32.7%	67.3%
Children will be taught basic word processing.	Count	2	95
	%	2.1%	97.9%
STS* programmed characterized			
Identify local real life problems.	Count	12	87
	%	12.1%	87.9%
Identify Local materials resource.	Count	13	86
	%	13.1%	86.9%
Seek solutions of problems actively.	Count	14	84
	%	14.3%	85.7%
Emphasis on process skills.	Count		98
	%		100.0%
Adopt decision-making roles.	Count	12	86
	%	12.2%	87.8%
Emphasis? cooperative learning.	Count	5	93
	%	5.1%	94.9%
Build vocabulary on the topic.	Count	2	96
	%	2.0%	98.0%
Build an understanding of the scientific processes involved in the topic.	Count		98
	%		100.0%
Build an understanding of the topic impact may have on society.	Count	8	90
	%	8.2%	91.8%
Build an understanding of how the resources relevant to the topic are organized and accessed.	Count	6	92
	%	6.1%	93.9%
Build an understanding of the social context in which the scientific work is done.	Count	9	89
	%	9.2%	90.8%

Appendix (K)

Student comment in Arabic

الملاحظات	الصف، التقدير	اجراء الباحثة
أتمنى أن أحصل عليه.	ثاني، جيد	ستوفرة الباحثة لجميع المدارس المشاركة.
أتمنى أن يكون لمواد أخرى	رابع، جيد جداً.	ستوصي الباحثة باعداد برامج لمواد أخرى.
أتمنى أن يكون هناك للحساب والعربي مثله.	رابع، جيد جداً	ستوصي الباحثة باعداد برامج لمواد أخرى.
أحب الكمبيوتر وأستمتع به قد يساعدني على تحسين علاماتي، والاستفاده من المعلومات، أراه أفضل من الكتاب.	رابع، ضعيف	أتمنى ذلك
أحب أن أراه لمواد أخرى.	رابع، جيد جداً	ستوصي الباحثة باعداد برامج لمواد أخرى.
أحب للعربي مثله	رابع، جيد	ستوصي الباحثة باعداد برامج لمواد أخرى.
أحببت العلوم أكثر.	ثاني، ممتاز	شكراً
أحببت العلوم، ياريت كمان الرياضيات.	رابع، ضعيف	شكراً، سيكون هناك للرياضيات في المستقبل.
أحببت كلمات الانجليزي.	ثالث، جيد.	شكراً
أحببته من أجل العلوم، العلوم رائع.	رابع، جيد جداً	شكراً
أحلى من الكتاب.	رابع، جيد جداً.	ستوصي الباحثة باعداد برامج لمواد أخرى.
ارجو توفيره لمواد أخرى.	ثالث، ممتاز	سنوفرة لك.
أرجو من المعلمة أن تحضره الى الصف.	ثاني، جيد	سنوفره لك.
أريده لمواد أخرى.	ثالث، جيد	
استمتعت بالأغاني، أريده لمواضيع أخرى.	ثاني، جيدجداً	ستوصي الباحثة باعداد برامج لمواد أخرى.
استمتعت بالافلام	ثاني،جيد	
استمتعت بفقرة انشاء المتحف بنفسي هذا رائع، سأجمع صور وافكار لأعمل واحد بنفسي.	أول، ممتاز	شكراً
استمتعت كثيراً، اتمنى ان احصل عليه، اريده لمواد أخرى.	ثالث، ممتاز	ستوفرة الباحثة للمدارس المشاركة.
أعجبتني الاغاني.		
أعجبني كثيرا الافلام العلمية، أحب أن أراه لمواد أخرى مثل العربي والرياضيات.	ثالث، ممتاز	ستوصي الباحثة باعداد برامج لمواد أخرى.
أعجبني كل شيء، كل شيء جميل تعليمي، تعرفنا على اجزاء النبات وهو أحلى تعرفنا كيف تنمو الشجرة. نأخذ	أول، ممتاز	شكراً

المعلومات.		
إن الصور مفيدة وجيدة، ونريد المزيد من البرامج	رابع، ممتاز	ستوصي الباحثة باعداد برامج لمواد أخرى.
إن الصور مفيدة ونريد المزيد من البرامج.	رابع، جيدجداً	ستوصي الباحثة باعداد برامج لمواد أخرى.
أنا أحب هذا البرنامج، وأتمنى لدي مثله.	ثالث، ممتاز	شكراً، سنوفره لك.
أنا استمتعت كثيراً وشكراً كثيراً.	ثالث، ممتاز	شكراً.
إنه جميل أحببته، ياريت لو كان عندي مثلة، علمني الكثير عن العلم.	ثالث، ممتاز	شكراً، سنوفره لك.
جعلني أحب العلوم أكثر، أريده لمواد أخرى رياضيات، عربي، وطنية.	ثاني، ممتاز	ستوصي الباحثة باعداد برامج لمواد أخرى.
جعلني أحب العلوم.	رابع، ممتاز.	شكراً
جميل أرجو من المدرسة توفيرة.	ثاني، ممتاز	شكراً، سنوفره لك.
جميل أرجو من المدرسة توفيرة، البرنامج يحقق معايير العلم.	ثاني، ممتاز	شكراً، سنوفره لك.
جميل ورائع جداً.	ثالث، جيد	شكراً
جميل ورائع جداً.	ثالث، ممتاز	شكراً
جميل ورائع ويعلمنا أشياء كثيرة.	ثالث، جيد جداً	شكراً
جميل ورائع.	ثالث، ممتاز	شكراً
جميل، أرجو من المدرسة توفيرة.	ثاني، جيد جداً	شكراً، سنوفرة للمدرسة.
جميل، سهل، سأطلب من والدي أقتناء واحد مثله.	رابع، جيد	شكراً، سنوفرة لك.
رائع سأخبر أمي بأنه جميل.	رابع، جيد جداً	شكراً
سأخبر امي عنه لاقتناءه.	أول، جيد جداً.	سنوفرة لك
سأكتب عنه في دفتر مذكراتي.	رابع، ممتاز.	شكراً
سهل جداً جميل نتعلم منه.	رابع، ممتاز	شكراً
سهل أريد أن أحصل عليه، أحببته كثيرا	رابع، ممتاز	باذن اللة الباحثة على المدارس المشاركة
سهل جميل أحبه كثيراً، أريد أن أحصل عليه.	رابع، ممتاز	شكراً، ستحصل علية.
كان هذا البرنامج ممتاز ورائع ومفيد، ولقد استمتعت في هذا البرنامج، أتمنى أن أستطيع أن أكرر هذه الفكره الممتعه والمفيده للعقل البشري وأتمنى، المزيد.	رابع، ممتاز	شكراً، ستوصي الباحثة باعداد برامج لمواد أخرى.
لعبة التصنيف أعجبتني كثيراً، أجزاء العين.	رابع، ممتاز.	شكراً
مضحك جداً.	ثاني، ممتاز	شكراً
مضحك جداً.	ثاني، ممتاز	شكراً
نتمنى أن يكون هناك لمواد أخرى.	رابع، ممتاز	أن شاء الله ستوصي الباحثة باعداد برامج لمواد أخرى.
نفهم أسرع من الكتاب.	أول، جيد	
وجدنا المتعة في الحاسوب، وحددنا مواقع العين، وشاهدنا	رابع، ممتاز	شكراً، ستوصي الباحثة باعداد

الكواكب، ورأينا المجموعة الشمسية، وقرأنا عن المجموعة الشمسية، ورأينا فيلم عن الحيوانات والكائنات المائية مثل: الحوت والزواحف، وغيرها ورأينا، أيضاً فيلماً عن العين كيف تنتقل الصورة للدماغ، واتمنى أن أكرر هذه الفكرة.		برامج لمواد أخرى.
يجعلني أحب العلوم أكثر.	ثالث، ممتاز	جميل جدا
يزيد من حبي للعلوم. احببته للعلوم العلوم رائع	ثالث، جيد	
يساعد في الدراسة.	ثاني، ممتاز	

Appendix (L.1)

Document for school
to participate in the user evaluation test

بسم الله الرحمن الرحيم

Al-Quds University
Faculty of Educational Science
Dean Office

جامعة القدس
كلية العلوم التربوية
مكتب العميد

الرقم: ب د ع/11/18/423/46
التاريخ: 2011/03/13

حضرة مديرة مدرسة قرطبة الأساسية المحترمة
الخليل

الموضوع: تسهيل مهمة

تحية طيبة وبعد،،

تقوم الطالبة : **بشرى عزت البدوي** ورقمها الجامعي (20811492)، بدراسة تتعلق برسالة ماجستير، بعنوان

" The Virtual Museum "VM" as a tool of science and technology literacy in informal environment "

لذا يرجى من حضرتكم تسهيل مهمة الطالبة المذكورة أعلاه والتعاون معها.

شاكرين لكم حسن تعاونكم

والله الموفق

كلية العلوم التربوية
Faculty of Educational Sciences

د. غسان سرحان
عميد كلية العلوم التربوية

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تلفون 02-2799753 فاكس 02-2796960 القدس ص.ب 20002

بسم الله الرحمن الرحيم

Al-Quds University
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جامعة القدس
كلية العلوم التربوية
مكتب العميد

الرقم: ب د ع/11/18/425/46
التاريخ: 2011/03/13

حضرة مديرة مدرسة SOS المحترمة
بيت لحم

الموضوع: تسهيل مهمة

تحية طيبة وبعد،،
تقوم الطالبة : **بشرى عزت البدوي** ورقمها الجامعي (20811492)، بدراسة تتعلق برسالة ماجستير، بعنوان

" The Virtual Museum "VM" as a tool of science and technology literacy in informal environment "

لذا يرجى من حضرتكم تسهيل مهمة الطالبة المذكورة أعلاه والتعاون معها.

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كلية العلوم التربوية
مكتب العميد

الرقم: ك ع ت/11/603/12
التاريخ: 2011/03/20م

حضرة أ. أميمة العناني المحترمة
مديرة مدرسة رياض الأقصى الأساسية

الموضوع: دعوة لتطبيق دراسة

تحية طيبة وبعد،،

تقوم الطالبة بشرى البدوي بإجراء دراسة، بعنوان

" The Virtual Museum "VM" as a tool of science and technology literacy in informal environment "

وضمن هذه الدراسة يتطلب تطبيقها على الطلاب من المرحلة الأساسية الدنيا، لذا يرجى من حضرتكم تقبل الدعوة، وذلك يوم الخميس الموافق 2011/03/31م، الساعة التاسعة صباحاً في مبنى كلية الآداب. مع العلم أن تكاليف المواصلات مؤمنة من قبل الباحثة.

مع فائق الاحترام والتقدير

د. غسان سرحان
عميد كلية العلوم التربوية

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كلية العلوم التربوية
مكتب العميد

الرقم: ب د ع/11/18/421/46
التاريخ: 2011/03/20

حضرة مدير مدرسة الفرير الثانوية المحترم
بيت لحم

الموضوع: تسهيل مهمة

تحية طيبة وبعد،،
تقوم الطالبة : **بشرى عزت البدوي** ورقمها الجامعي (20811492)، بدراسة تتعلق برسالة ماجستير، بعنوان

" The Virtual Museum "VM" as a tool of science and technology literacy in informal environment "

لذا يرجى من حضرتكم تسهيل مهمة الطالبة المذكورة أعلاه والتعاون معها.

شاكرين لكم حسن تعاونكم

والله الموفق

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بسم الله الرحمن الرحيم

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جامعة القدس
كلية العلوم التربوية
مكتب العميد

الرقم: ب د ع/11/18/424/46
التاريخ: 2011/03/13

حضرة مدير مدرسة الرشيد الأساسية المحترم
شمال الخليل

الموضوع: تسهيل مهمة

تحية طيبة وبعد،،

تقوم الطالبة : **بشرى عزت البدوي** ورقمها الجامعي (20811492)، بدراسة تتعلق برسالة ماجستير، بعنوان

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لذا يرجى من حضرتكم تسهيل مهمة الطالبة المذكورة أعلاه والتعاون معها.

شاكرين لكم حسن تعاونكم

والله الموفق

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مكتب العميد

الرقم: ب د ع/11/18/424/46
التاريخ: 2011/03/13

حضرة مدير مدرسة الرشيد الأساسية المحترم
شمال الخليل

الموضوع: تسهيل مهمة

تحية طيبة وبعد،،

تقوم الطالبة : **بشرى عزت البدوي** ورقمها الجامعي (20811492)، بدراسة تتعلق برسالة ماجستير، بعنوان

" The Virtual Museum "VM" as a tool of science and technology literacy in informal environment "

لذا يرجى من حضرتكم تسهيل مهمة الطالبة المذكورة أعلاه والتعاون معها.

شاكرين لكم حسن تعاونكم

والله الموفق

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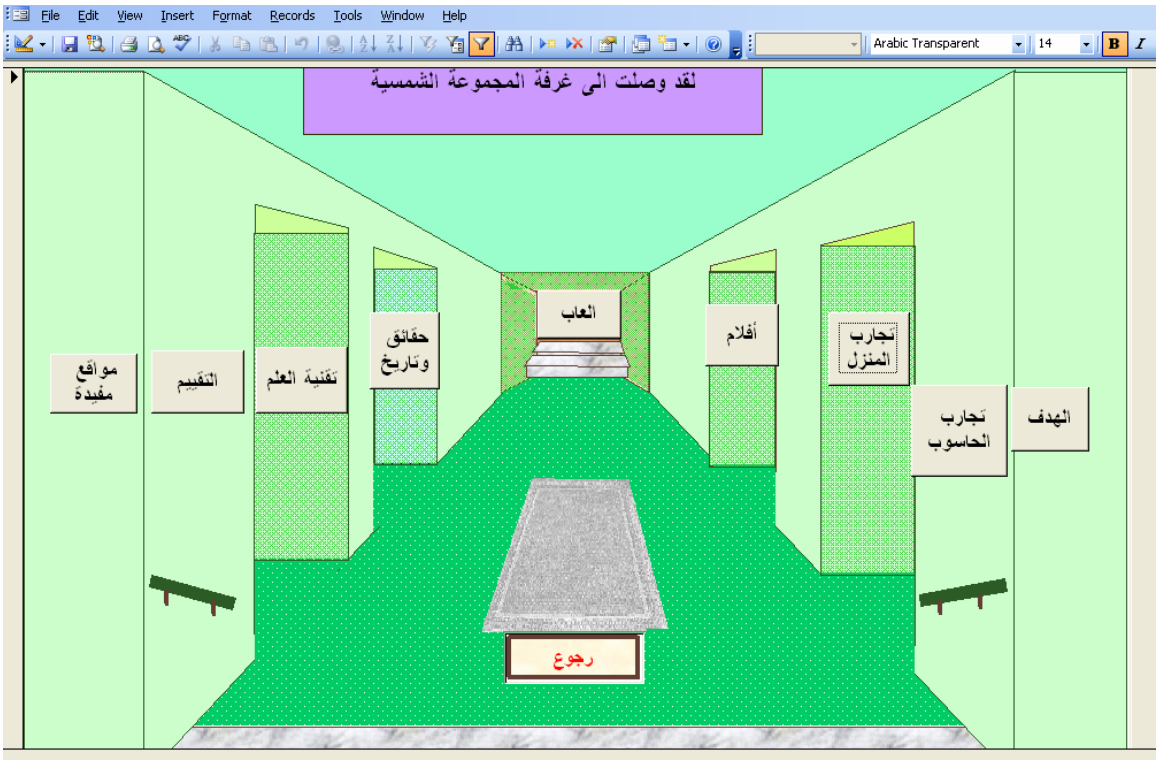
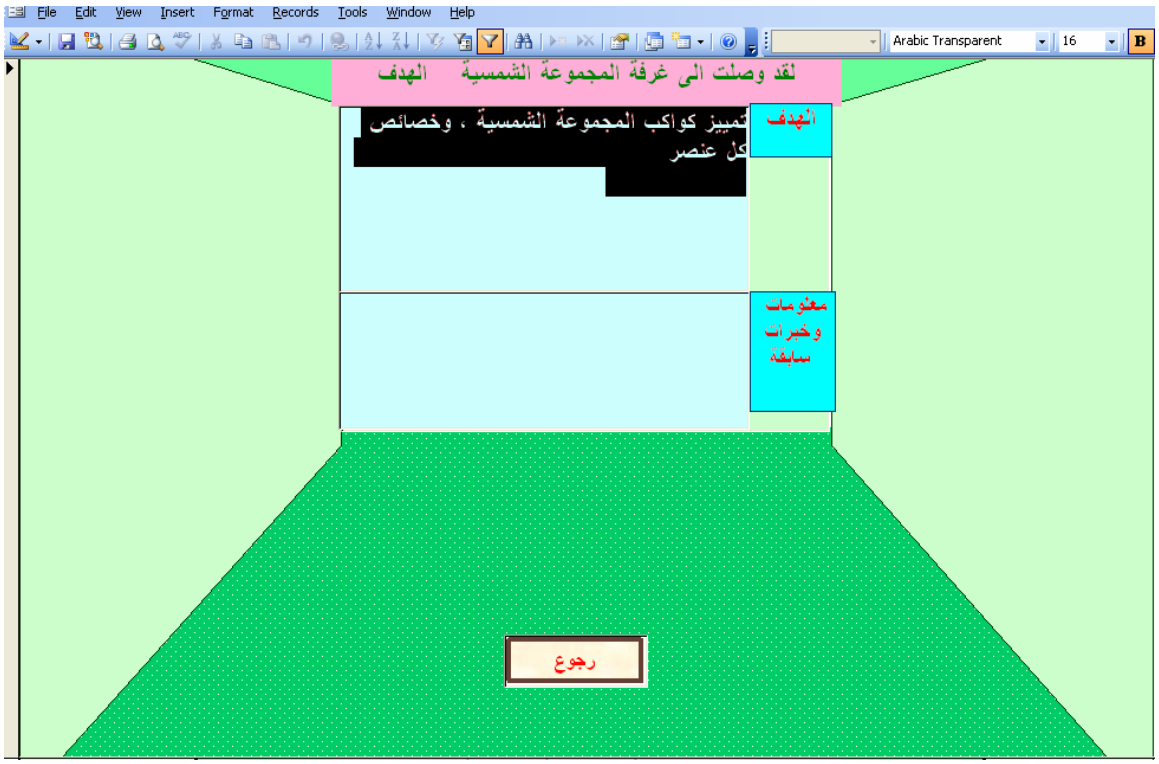
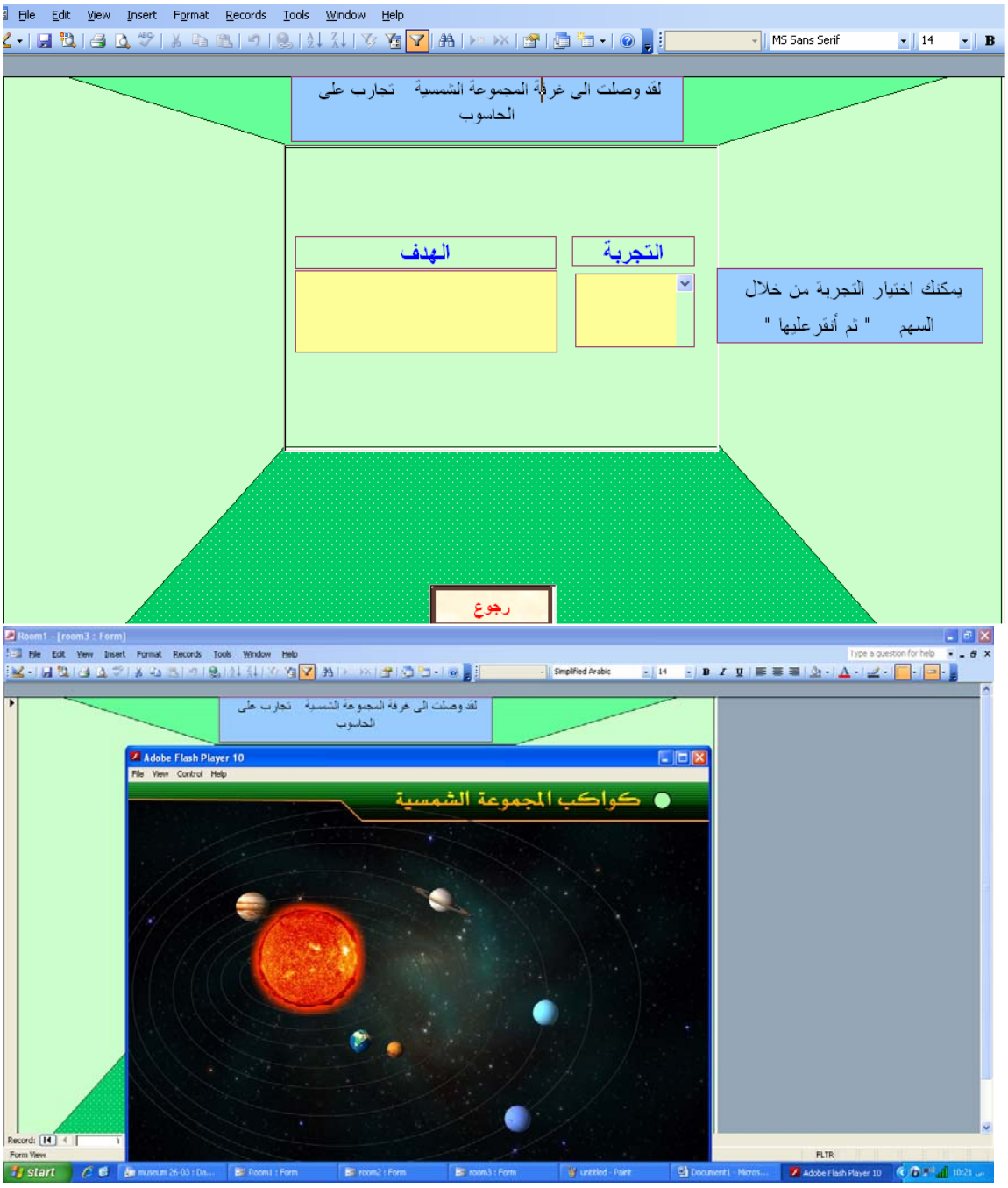
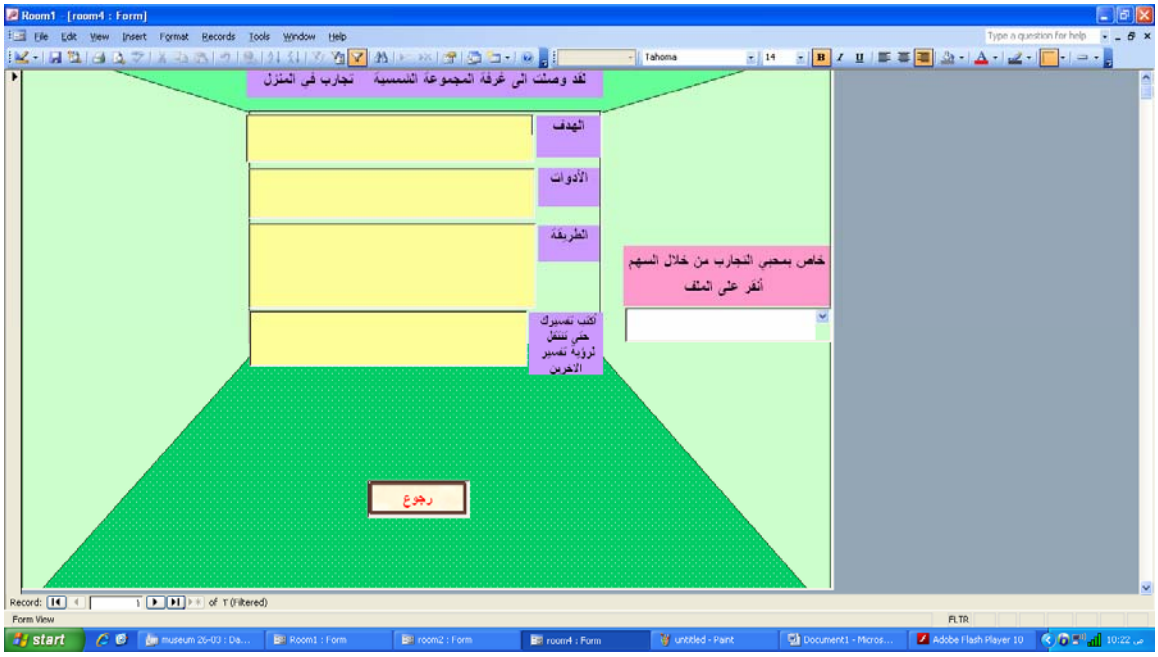
Appendix (M.1)
Virtual Museum “Solar System rooms as example”

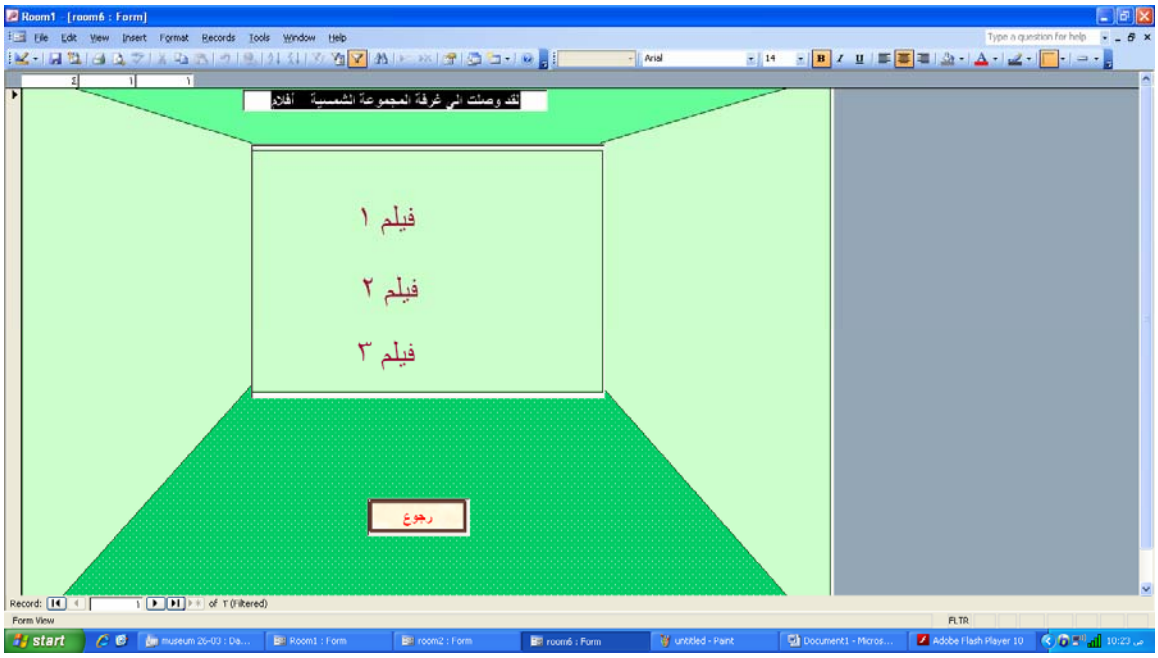

File Edit View Insert Format Records Tools Window Help
Arabic Transparent
14
لقد وصلت الى غرفة المجموعة الشمسية
العاب
أفلام
تجارب المنزل
تجارب الحاسوب
الهدف
حقائق وتاريخ
تقنية العلم
التقييم
مواقع مفيدة
رجوع

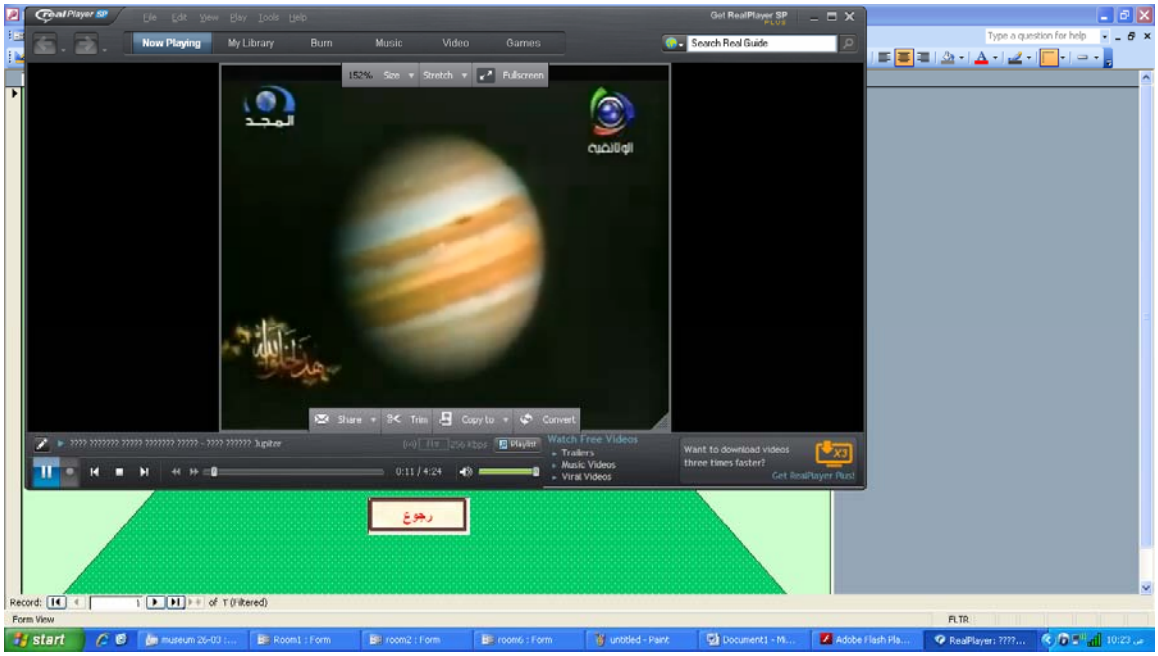

File Edit View Insert Format Records Tools Window Help
Arabic Transparent
16
لقد وصلت الى غرفة المجموعة الشمسية الهدف
الهدف
تمييز كواكب المجموعة الشمسية ، وخصائص كل عنصر
معلومات وخبرات سابقة
رجوع

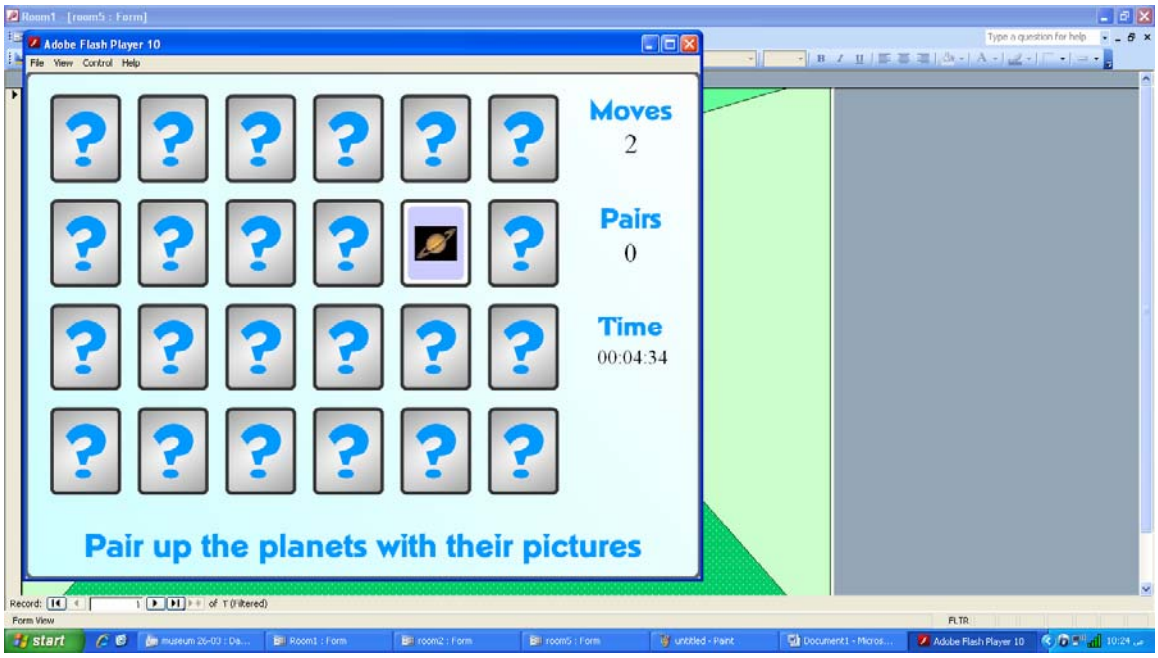

File Edit View Insert Format Records Tools Window Help
MS Sans Serif
14
لقد وصلت الى غرفة المجموعة الشمسية تجارب على الحاسوب
الهدف
التجربة
يمكنك اختيار التجربة من خلال السهم " ثم أنقر عليها "
رجوع
Room1 : [room3 : Form]
Adobe Flash Player 10
File View Control Help
كواكب المجموعة الشمسية
start

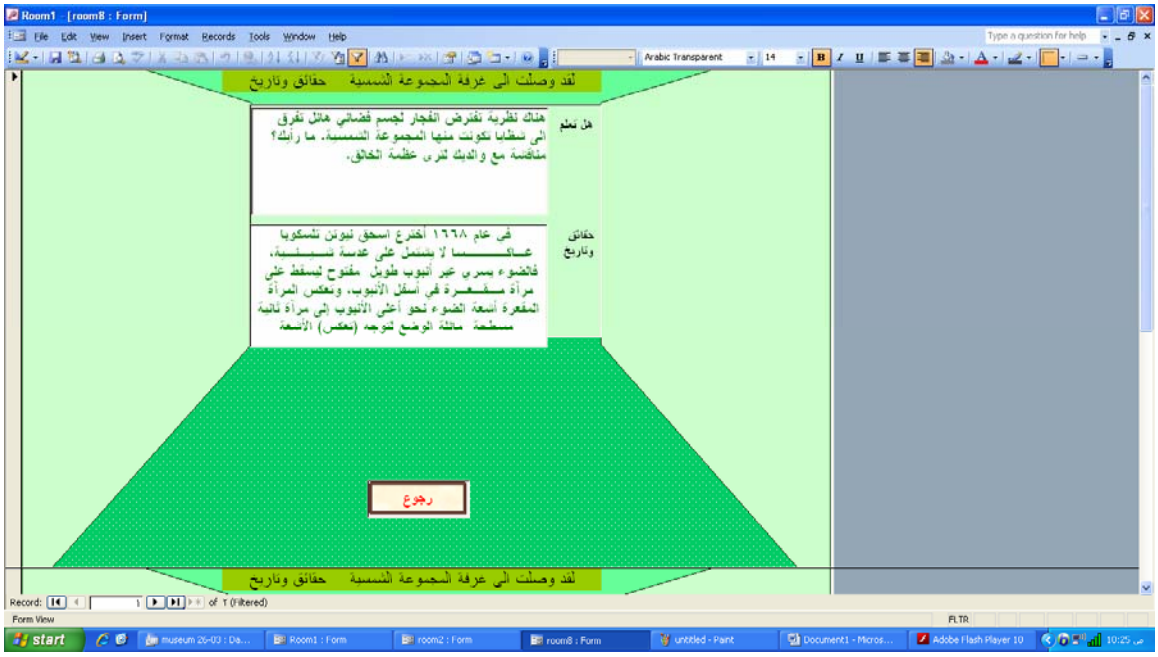

لقد وصلت الى غرفة المجموعة الشمسية تجارب على الحاسوب
Adobe Flash Player 10
File View Control Help
كواكب المجموعة الشمسية
هو من الكواكب الكبيرة
ويظهر باللون الأزرق
ويحيط به ١٨قمار
نبتون

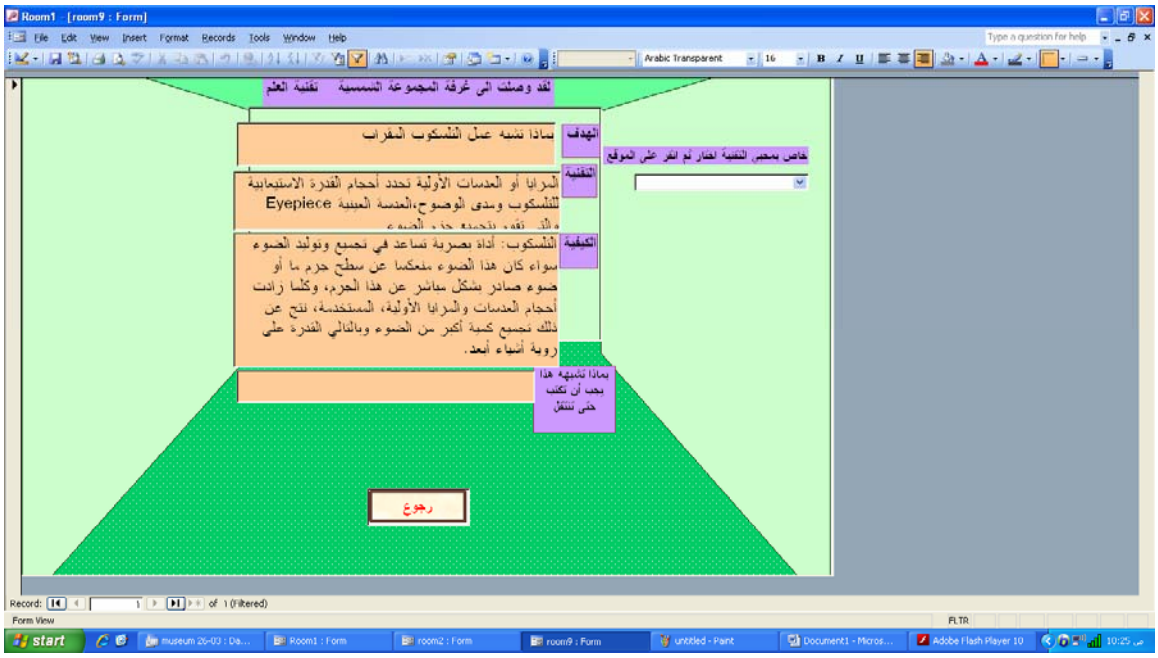

لقد وصلت الى غرفة المجموعة الشمسية تجارب في المنزل
الهدف
الأدوات
الطريقة
اكتب تفسيرك حتى تتنقل لرؤية تفسير الآخرين
خاص بسحب التجارب من خلال السهم
أنقر على الملف
رجوع

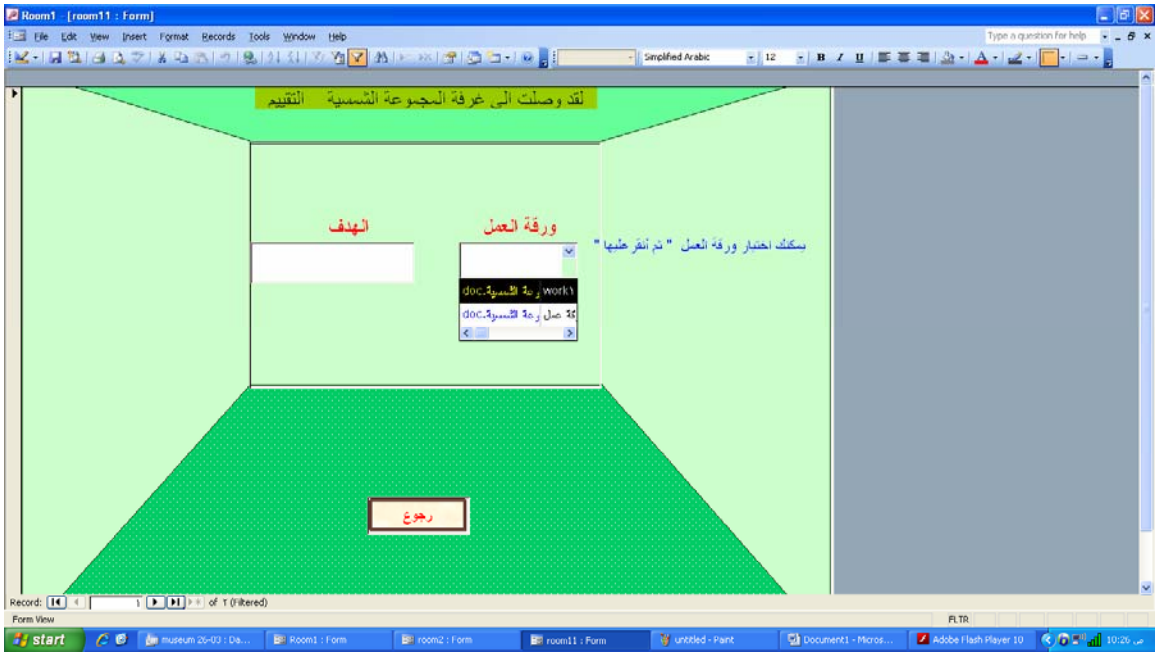

Room1 : [room6 : Form]
لقد وصلت إلى غرفة المجموعة الشمسية أفلام
فيلم ١
فيلم ٢
فيلم ٣
رجوع


Now Playing
My Library
Burn
Music
Video
Games
Search Real Guide
المجد
الواقعية
رجوع


Adobe Flash Player 10
File View Control Help
Moves
2
Pairs
0
Time
00:04:34
Pair up the planets with their pictures


لقد وصلت الى غرفة المجموعة الشمسية حقائق وتاريخ
هل تعلم
هناك نظرية تفترض انفجار نجم قضائي هائل تفرق الى نيظايا تكونت منها المجموعة الشمسية. ما رأيك؟ مناقشة مع والديك لترى عظمة الخالق.
حقائق وتاريخ
في عام ١٦٦٨ أخترع اسحق نيوتن تلسكوبا عاكسا لا يشتمل على عدسة شيئية. فالضوء يسري عبر أنبوب طويل مفتوح ليسقط على مرآة مقعرة في أسفل الأنبوب. وتعكس المرآة المقعرة أشعة الضوء نحو أعلى الأنبوب إلى مرآة ثانية مسطحة مائلة الوضع توجه (تعكس) الأشعة
رجوع
لقد وصلت الى غرفة المجموعة الشمسية حقائق وتاريخ


Room1 : [room9 : Form]
لقد وصلت الى غرفة المجموعة الشمسية تقنية العلم
الهدف
بماذا تشبه عمل التلسكوب المقرب
التقنية
المرايا أو العدسات الأولية تحدد أحجام القدرة الاستيعابية للتلسكوب ومدى الوضوح،العدسة العينية Eyepiece
الكيفية
التلسكوب: أداة بصرية تساعد في تجميع وتوليد الضوء سواء كان هذا الضوء منعكسا عن سطح جرم ما أو ضوء صادر بشكل مباشر عن هذا الجرم، وكلما زادت أحجام العدسات والمرايا الأولية، المستخدمة، نتج عن ذلك تجميع كمية أكبر من الضوء وبالتالي القدرة على رؤية أشياء أبعد.
بماذا تشبهه هذا يجب أن تكتب حتى تنتقل
خاص بمحور التقنية اختار ثم انقر على الموقع
رجوع


Room1 : [room11 : Form]
لقد وصلت الى غرفة المجموعة الشمسية التقييم
الهدف
ورقة العمل
يمكنك اختيار ورقة العمل " ثم انقر عليها "
رجوع

كواكب المجموعة الشمسية

٤٣

الاسم : _____ الصف الرابع

الهدف: أن يميز الطالب/ة بعض الكواكب من خلال الصور

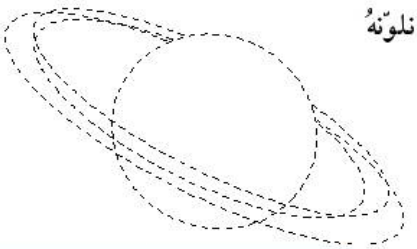
■ عزيزي/ تي وليّ/ ة الأمر ، ، تابع ولدك اثناء تنفيذه النشاط التالي : –

نشاط

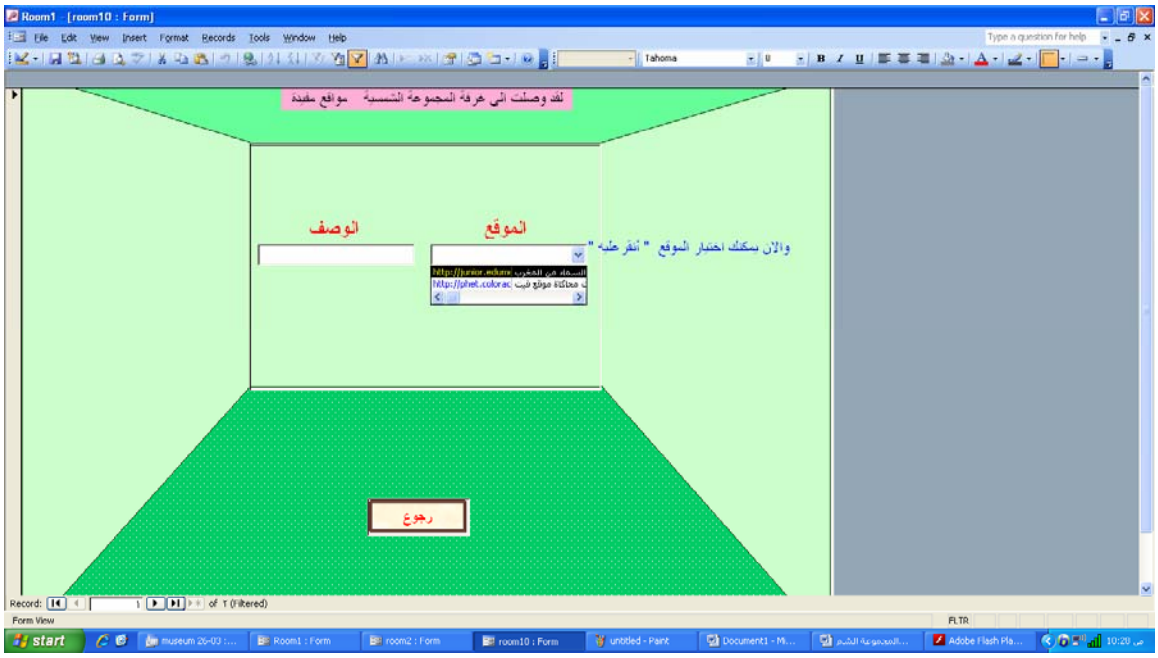
■ صديقي الصغير ، ، هيّا نصل الجرم السّماوي في العمود (أ) بالصورة المناسبة من العمود (ب) :

العمود (أ)	العمود (ب)
الأرض	
المرّيخ	
أورانوس	
المشتري	

■ والآن، هيّا نخرج قلم الرصاص ونكمل الرسم ثُمّ نلوّنهُ

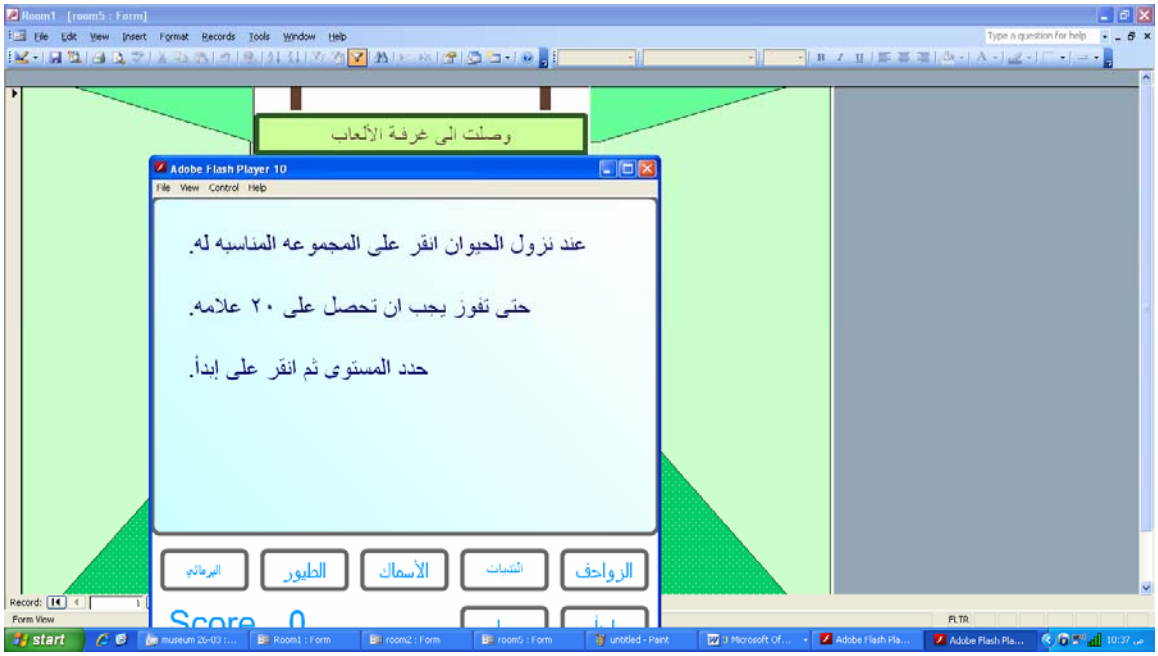


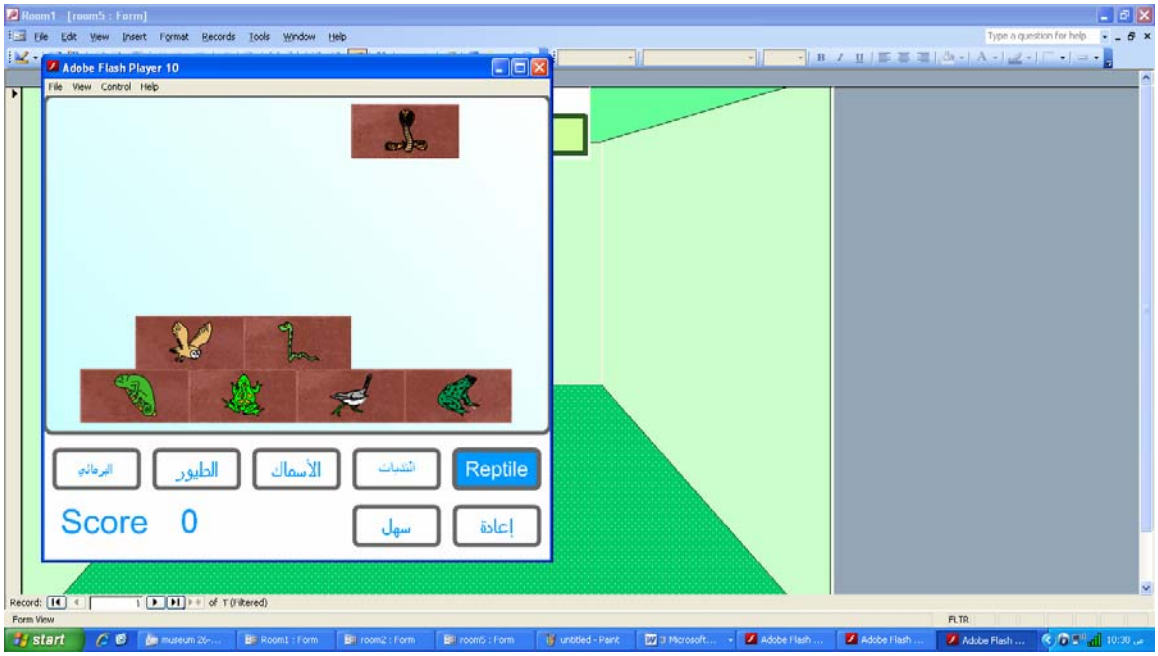
توقيع وليّ/ ة الأمر : _____


Room1 : [room10 : Form]
لقد وصلت الى غرفة المجموعة الشمسية مواقع مفيدة
الوصف
الموقع
والان يمكنك اختيار الموقع " انقر عليه "
رجوع

Appendix M.2

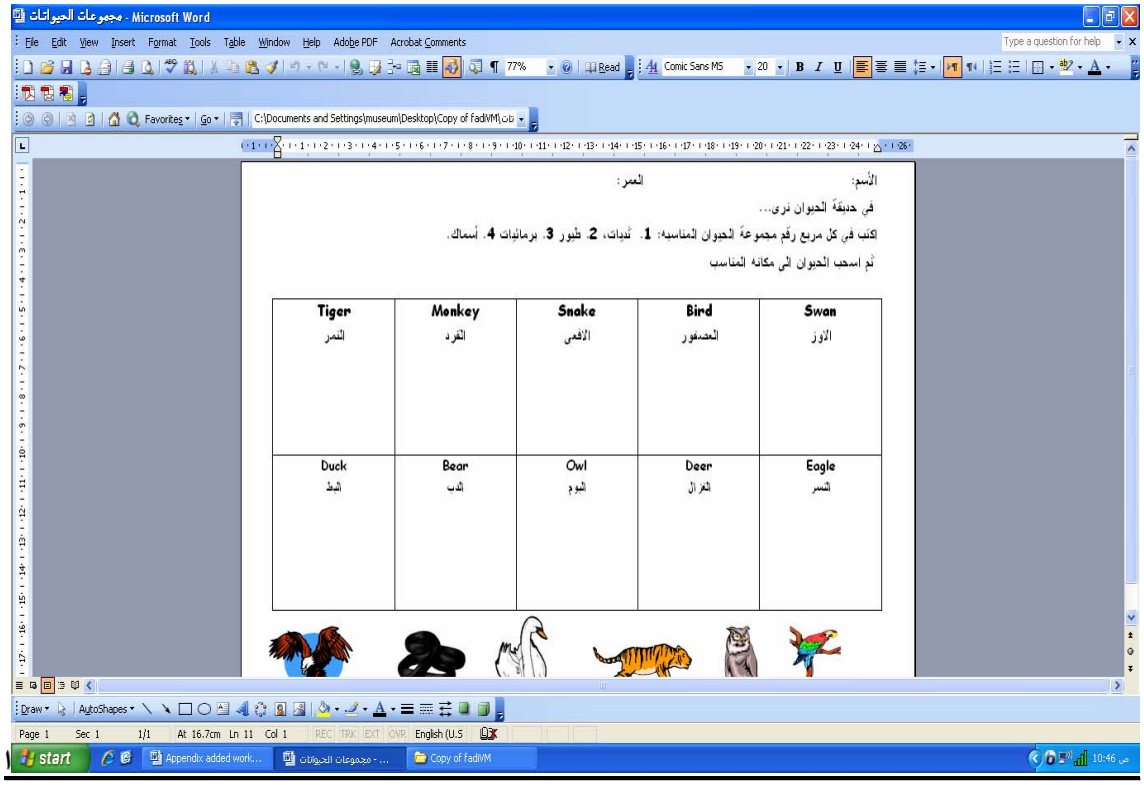
Added games

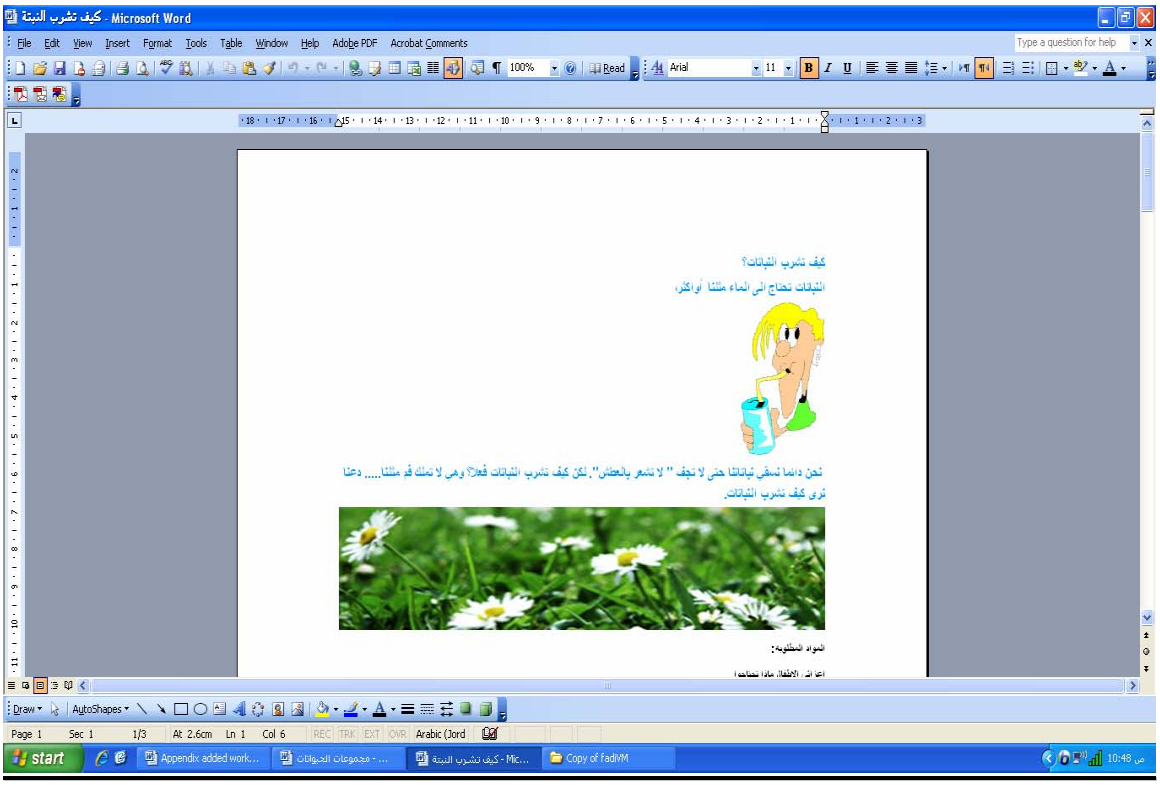




Appendix (M.3)

Added work sheets




كيف تشرب النبتة - Microsoft Word
كيف تشرب النباتات؟
النباتات تحتاج الى الماء مثلنا أو اكثر.
نحن دائما نسقي نباتاتنا حتى لا تجف " لا تشعر بالعطش". لكن كيف تشرب النباتات فعلا؟ وهي لا تملك فم مثلنا..... دعنا نرى كيف تشرب النباتات.
المواد المطلوبة:

العين والرؤيا

- **أجزاء العين:**

الهدف العام: يتعرف على أجزاء العين ووظائفها.

عزيزي الطالب : من خلال ما درست سابقاً أجب عما يلي:

1- تتركب العين من ثلاث طبقات رئيسية: ـــــ، ـــــ، ـــــ.
2- حدّد وظيفة كلاً من:
أ- القرنية: _____.
ب- المشيمية: _____.
ج- العصب البصري: _____.
د- خلايا الاستقبال الضوئي: _____.

الأدوات اللازمة : جهاز الحاسوب، مجسم العين، عين خروف طازجة، مصباح جيب، ورقة بيضاء، أدوات تشريح.

عزيزي الطالب : عليك النظر في عين زميلك ثم أجب عما يلي :

1- ماذا يوجد خلف القرنية؟ _____.
2- صف القزحية؟ _____.
3- اذكر فائدة القزحية؟ _____.

- ولتتعرف كيف تتحكم القزحية في تنظيم كمية الضوء الداخلة للعين نفذ النشاط (3) المرفق.
- الملاحظة: _____.

الاستنتاج: _____.

4- يتسع بؤبؤ العين أحياناً ويضيق أحياناً..... فسر ذلك؟
5- ماذا يوجد خلف القزحية؟ _____.
6- صف عدسة العين؟ _____.
7- اذكر وظيفة عدسة العين البلورية؟ _____.
8- يوجد في التجويف بين القرنية وعدسة العين سائل شفاف يسمى _____.
9- يوجد في التجويف بين العدسة والشبكية سائل يسمى _____.
10- ما أهمية وجود السائل الزجاجي والسائل المائي في تجاويف العين؟
_____.

- قم أنت وزملاءك وبمساعدة ولي الأمر إن أمكن بتشريح عين خروف طازجة حسب خطوات النشاط () المرفق.

استخدم ما تعلمت:

1- الجزء الذي يتحكم بكمية الضوء الداخل إلى شبكية العين:
أ- القرنية ب- الحدقة ج- القزحية د- البقعة الصفراء
2- عندما يفقد شخص ما إحدى عينيه فإنه يفقد من البصر:
أ- 2/1 البصر ب- 4/1 البصر ج- 3/1 البصر د- 5/1 البصر
3- لماذا عدسة العين محدبة الشكل وليست مقعرة؟
_____.

- **كيف نرى الأجسام:**

الهدف العام: يتعرف على بعض عيوب الإبصار وطرق معالجتها.

عزيزي الطالب : من خلال الدراسة السابقة أجب:- الجزء الحساس للضوء في العين هو___.

1- اذكر وظيفة كلاً من: أ- المشيمية: _____.

ب- العدسة البلورية: _____.

ج- خلايا الاستقبال الضوئي: _____.

2- عدّد بعض أمراض العيون: ___، ___، ___، ___.

عزيزي الطالب : لعلك كنت جالس مع أسرتك في صالون البيت ليلاً وانقطع التيار الكهربائي فجأة وأردت مغادرة المكان ثم بعد ذلك أنارت الكهرباء

والآن أجب عن الأسئلة التالية :

1- اشرح كيف نرى الأجسام من حولنا؟ _____.

2- العالم المسلم الذي فسر لنا رؤية الأجسام هو _____.

- ابحث في مكتبة المدرسة، أو المنزل أو الحي ان وجد:

وجه المقارنة	عيب طول النظر	عيب قصر النظر
الأعراض		
سبب الحدوث		
طريقة العلاج		

2

علل لما يلي: 1- تستخدم نظارة ذات عدسة محدبة لمصاب بطول النظر؟

_____

_____

2- تستخدم نظارة ذات عدسة مقعرة لمصاب بقصر النظر؟

_____

_____

3- اقترح بعض الطرق للمحافظة على صحة العيون؟

أ- _____

ب- _____

ج- _____

د- _____

استخدم ما تعلمت: 1- اختر الإجابة الصحيحة:

أ- الشكل التالي يدل على أن الشخص مصاب بـ:

1- قصر نظر 2- حول 3- طول نظر 4- عمى ألوان

ب- مرض ناتج عن عدم توافق حركة العينين في نفس الاتجاه:

1- الماء الأزرق (الجلوكوما) 2- الحول 3- الماء الأبيض (الكاتركتا) 4- انفصال الشبكية

ج- تتكون صورة الأجسام على شبكية العين وتكون الصورة:

1- تقديرية مصغرة معتدلة 2- حقيقية مصغرة معتدلة

3- حقيقية مصغرة مقلوبة 4- حقيقية معتدلة مساوية للجسم

- رجل يستخدم نظارة قراءة، اكتب تصورك عما يعانيه. ما نوع عدسة النظارة. وهل النظارة مفيدة له لماذا؟

الخلاصة :

* تتركب العين من ثلاث طبقات رئيسة :

أ- الطبقة الخارجية (الصلبة)

ب- الطبقة الوسطى (المشيمية)

ت- الطبقة الداخلية (الشبكية)

* عندما يسقط الضوء على الأجسام ينعكس عنها إلى العين فتتمكن العين من الرؤية.

* من أمراض العيون :
طول النظر – قصر النظر – الجلوكوما – الحول – عمى الألوان

اختبار

السؤال الأول: ضع دائرة حول رمز الإجابة الصحيحة:

1- تتكون صورة الأجسام على شبكية العين وتكون الصورة:

أ- تقديرية مصغرة معتدلة. ب- حقيقية مصغرة معتدلة

ج- حقيقية مصغرة مقلوبة د- حقيقية معتدلة مساوية للجسم

السؤال الثاني: اذكر فائدة واحدة لكل من:

1- القرنية: _____.

2- القزحية: _____.

3- الصلبة: _____.

السؤال الرابع: علل لما يأتي:

1- اتساع حدقة العين عندما يكون الضوء خافت؟

السؤال الخامس: قارن بين كل من:

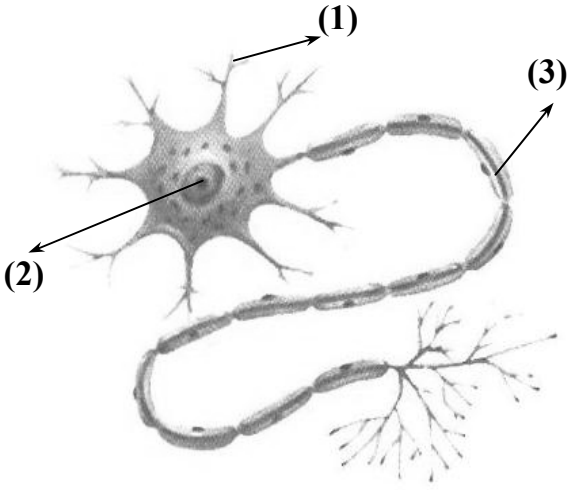
وجه المقارنة	قصر النظر	طول النظر
العلاج		

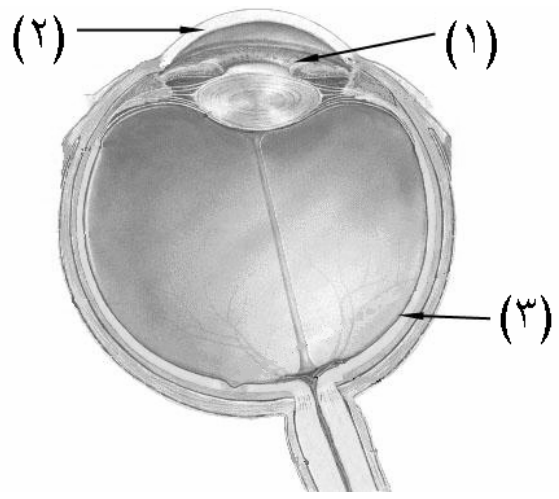
السؤال السادس: اكتب أسماء الأجزاء المشار إليها بالسهم:

1- _____. 1- _____.

2- _____. 2- _____.

3- _____. 3- _____.



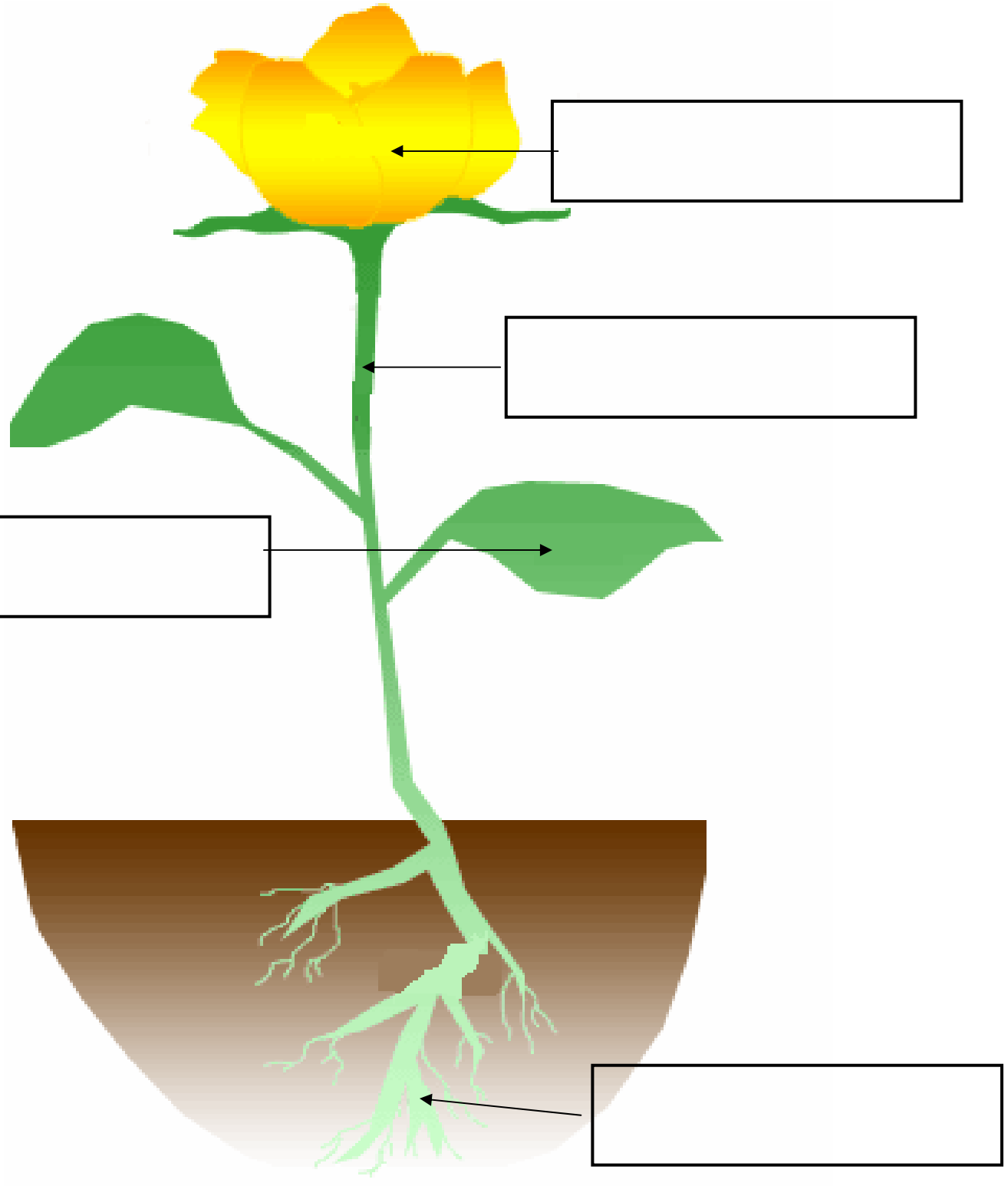


الاسم:

أجزاء النبتة

اسحب الجزء المناسب من النبته الى مكانه

الزهره	الجذور	الأوراق	الساق



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