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The Virtual Museum VM as a Tool for Learning Science in Informal Environment

El museo virtual VM como herramienta para el aprendizaje de la ciencia en un entorno informal

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ABSTRACT

This study aims to check if a Virtual Museum (VM) is a tool for learning science in an informal environment for lower basic grades from the perspective of parents and children. The study followed the mixed method quantitative and qualitative data collected from the main field-testing stage from the perspective of the user (children and parents) in the educational Research and Development (R & R&D) methodology, the evaluation tools used as instruments for parents, and one for parents for children with a focused interview. The parents' evaluation test yielded positive feedback, and the parents found that the VM is appropriate. The parents were similar in their opinion toward the VM to academic qualifications. The children's evaluation test yielded positive feedback. Children found that the VM is appropriate. Children's comments showed a greater interest level in learning science with technology through gaming and multimedia. They were very excited about using the VM, which helped them understand the subject content and navigate to search for scientific information.

Palabras clave:
Museo virtual (VM)
Museo virtual de ciencias
Aprendizaje informal
Aprendizaje formal

RESUMEN

Para comprobar si un museo virtual puede ser una herramienta para el aprendizaje de la ciencia en los grados básico de enseñanza, en un entorno informal, desde la perspectiva de padres e hijos, el estudio siguió el método mixto de recogida de datos cuantitativos y cualitativos desde la perspectiva del usuario (estudiante y padres) basado en la metodología de investigación y desarrollo (I+D) de la educación, utilizando herramientas de evaluación apropiadas y diferenciadas para los padres y para los niños, por medio de una entrevista enfocada. La prueba de evaluación de los padres arrojó resultados positivos: encontraron los VM apropiados. Los padres manifestaron también una opinión positiva hacia el VM en relación con las calificaciones académicas. La prueba de evaluación de los niños dio una respuesta positiva. Los niños encontraron apropiados los VM. Los comentarios de los niños mostraron un mayor nivel de interés en el aprendizaje de la ciencia con la tecnología a través de juegos y multimedia: los niños estaban muy entusiasmados con el uso de la VM que les ayudó a entender el contenido del tema y a navegar para buscar información científica.

1. Introduction

Thinking about how children learn has been entirely affected by technology, particularly by computers, the Internet, and web-based resources.

People who are living in today's world are encountering new scientific and technological advancements every day. 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

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these developments. At the same time, we live in a world that is increasingly dependent on technology (Dugger, 2001). Therefore, people who are careless about technology could hardly succeed in today's life.

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).

Informal learning includes museums, science centers, community organizations, aquaria, zoos, botanical gardens, and 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 strengths and weaknesses. Formal education allows students to learn content in depth; teachers are 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 their interest in the science, they love (French, 2007). Distinguishing between formal education and informal education offers more freedom of choice to learn about the material presented.

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).

Buckingham (1993) believes that information technology education must develop the relationship between what is taught in schools and the technology that children are engaged with at home. With the internet boom, many households have access to the web for successful integration.

The research presented an evaluation for the virtual museum from the perspective of parents and children as experts.

2. Purpose and Research questions

To evaluate a virtual museum as a tool for learning science in an informal environment for lower Basic grades from the perspective of (parents and children).

To check a user-centered Virtual Museum.

Could the *VM,* as an informal tool, play a role in learning science of lower basic grades?

Could the parents cooperate effectively to implement a virtual museum that promotes science concepts 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 on academic qualifications (diploma, B.A, and upper than B.A)?

Could the children cooperate effectively using a virtual museum that promotes science concepts 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's opinions related to grades (first, second, third, and fourth)?

3. Definitions

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

Formal education: The traditional way in teaching science for elementary class one teacher tells is that many students listen.

Informal education: This is the education outside 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).

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 contextualized learning (Al-badawi, 2011).

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

4. Previous studies related to VM usability and informal environment

Lepouras et al. (2004) demonstrated findings gathered from creating a multi-thematic virtual museum environment to be offered to visitors of real-world museums. The designer must develop an intuitive, consistent, user-friendly, stimulating virtual environment with rigid hardware, able to withstand heavy, everyday use.

Lim and Edirisinghe (2007) explore Second Life as a learning environment for computer science subjects. With the pilot study, the instruments used for data collection were the tutors' journals, interviews with tutors. The keys results are an increased level of student engagement and learning activities perceived as a good form of practice.

Khaled (2008) aimed to investigate the effect of employing a virtual learning environment of teaching science on the sixth graders' achievement at UNRWA schools in the Nablus District. The sample included (146) students of both sexes. There were significant differences at (α=0.05) in science achievement and preservation.

As Delello (2009) declared 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 on a snowball sampling, and a questionnaire focused on both a U.S. middle school and a Chinese middle school audience. Students showed a greater interest level in learning science with technology through online gaming.

Dar Saleh (2010) found out the effect of using educational software programs in teaching 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. 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.

There are many compelling reasons for believing that virtual museums for children warrant serious investigation. The researcher has prioritized the recommendations of Lepouras et al. (2004) that the designer must develop an intuitive, consistent, user-friendly, stimulating virtual environment. Delello (2009) 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) designed the VM to accommodate different learning styles.

Laghos (2010) provided feedback on the children's interface, usability, and acceptance; informal interviews were carried out with the children and their parents. The Pappa and Pannese (2010) evaluation framework includes three main analysis dimensions: technical verification, User Experience evaluation, and pedagogical aspects evaluation (evaluation of learning outcome). To improve learning and motivation, educational game design should target all three dimensions. Failing to meet the requirements of one dimension could compromise the effectiveness of learning and combine questionnaires with targeted interviews.

García-Peñalvo and Griffiths (2014) analyze problems experienced by validating informal learning and propose alternative approaches. There is a mismatch between the enthusiasm of policymakers and other actors for informal learning initiatives and the lack of adoption of systems in real workplaces. The use of managerial tools, such as validation and competence catalogs, has demonstrated the danger of constraining the scope for informal learning. They would like to advance and explore other different approaches to achieve the challenge of defining a very transparent framework in which both formal and informal learning are considered essential components of one's own person's knowledge base.

Aristeidou and Spyropoulou (2015) have the purpose of engaging adults with collaborative science and technology activities within the 3D Virtual World (VW) Second Life (SL). The Technology and Science Experiences

Virtual Scenarios (TSEvs) is a work in progress project focused mainly on its educational aspect and principles. SL demonstrates increased motivation and active participation, which constitutes a significant criterion for using it in Lifelong learning. Furthermore, the potential of SL in education is currently being explored, and new opportunities are being discovered that may improve the TSEvs and lead them to new, more efficient directions.

Sabbatini (2003) investigates the current theoretical and practical scenario of virtual science museums and science centers on Internet through the analysis of the concepts of science museum and virtual museum, also describing the contents, resources, and characteristics of the virtual museum, besides commenting on questions of practical character in the operation of the virtual museums. Identify the contents, functionalities, and approaches of the virtual museum, with particular emphasis on reality.

Griffiths and García-Peñalvo (2016) conceived a response to transferring knowledge and experiences from informal to formal learning contexts. It is easy to see why a solution to this problem would be desirable. Moreover, there is a widespread consensus in policy that an effective formal education system is a critical factor in achieving economic success. Therefore, it is an attractive proposal to suggest that these informal activities could be harnessed to strengthen the education system and that some of the methods of formal education would be applied to increase the effectiveness of informal learning.

Fuentes et al. (2019) aim to analyze the integration of Tablets in Spanish Schools, considering some of the critical aspects of the educational-technological innovation. A test completed by 1778 primary and secondary school students from 31 schools and 6 autonomous communities is provided.

They found that there are no significant changes in teacher's evaluation methods, concerning the methods used before the introduction of Tablets; the lack of innovation methodologies associated with technology, especially those referred to video games and online collaboration; the high level of coexistence between Tablets and other analogical resources, which points out the existence of a mixed model of technological integration; the receptivity to tablets shown mainly by students, but also by teachers and parents.

Lavonen and Villalba-Condori (2019) designed the development programs in the Basic Education Forum and the Finnish Teacher Education Forum. Moreover, the preparation of the National Core Curriculum for Basic Education is introduced and analyzed, the use of digital tools and environments in education is analyzed as a part of the preparation and implementation of the programmed and curricula.

5. Methodology

5.1. Design of the study

This study investigated parents and children 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 learning science in an informal environment.

This research has followed Research and Development (R&D) methodology for developing educational *VM* proposed by (Gall et al., 2003).

The research design followed the last stage in the educational R&D methodology as a mixed method in collect data qualitative, quantitative.

5.2. Population

Students of lower basic grades from (1-4).

Parents of students of the lower basic grades.

5.3. Sampling

Subsets of a non-parametric purposive sampling are chosen (students and parents).

Experts' participants

- Volunteer parents have been selected from the parents of the lower basic students who volunteered.
- In addition, students of lower basic grades from (1-4) have been selected from the schools accepted to participate.

Study sample

- A group of students from lower basic grades (1-4) in Jerusalem district, Bethlehem, and Hebron, participated in this study, depending on the grades (1-4).
- A group of Volunteer Parents of the students whose diversity depended on academic qualification, their students' grades from (1-4).
- The formal study sample has participated in the preliminary field test primary field test *(User Evaluation)* as described later.

5.4. The variables

Independent variables:

- 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 parents and children about the VM as a tool of learning science in an informal environment.

5.5. Data collection tools and data collection process

The VM as a tool: developed by (Al-badawi, 2011)

The research design of this study has followed the educational R&D methodology (the stage of main field test) outlined by (Gall et al., 2003). There was a seven-step development cycle. Educational R&D products followed a process of field-testing, evaluation, and refinement of producing functional educational products and programs, which has been used in (Al-badawi, 2011). This research used the stage of user evaluation in the preliminary field test.

Al-badawi's (2011) research is a smaller scale study than intended (Gall et al., 2003). In this research, the researcher uses the main field testing from the perspective of students and parents.

Evaluation tools: The researcher used the instruments from (Al-badawi, 2011) for parents and children.

Prepare evaluation tools: Through evaluation criteria, after reviewing the relevant literature and previous studies (Alsumait & Al-Osaimi, 2010), the researcher constructed two instruments, one for parents and one for children.

Virtual Museum VM parents' evaluation form: This instrument consisted of three parts, the first one containing information about the parent's qualifications (lower than a two-year diploma, B.A, Diploma, upper than B.A, Others), and child's grade, and the second one contained criteria related to the VM evaluation form which consisted of 70 items divided into nine domains: 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. The instrument was translated into Arabic, two judgment translators agreed on 90% of the translated items.

Virtual Museum VM children's evaluation form: This instrument consisted of three parts, the first one containing information about the children's grades. 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. The instrument was translated into Arabic, two judgment translators agreed on 92% of the translated items.

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, the technology of science, games, helpful link, and Audio-visual tools (like short films) complete this innovative Virtual Museum updated from (Al-badawi, 2011).

Focus group interview: After finishing the evaluation, the VM, a half-hour focus group interview, was conducted to elicit these students' in-depth perceptions of VM use. Ten participants were selected for the interview, as those students were more willing to share their feelings and relied primarily on 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 of the VM so that the participants would have the most time to experience the project activities and formed their opinions about them. Although the interviews were conducted informally, 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, several qualified experts provided 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 written. Their suggestion refined the instruments after confirmation of the validity of the instruments which were used.

Main Field Test *(User Evaluation):* A preliminary field test was completed using a pilot study from lower Basic grades (1-4) 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 preliminary 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 monitored them; for any clarification; when they completed the instrument that served as the main evaluation tool. The sample was conducted in 5 to 15 schools with 30 to 100 subjects—interview, observational, and questionnaire data collected and analyzed (Gall et al., 2003).

User's participants in this step

- Students from lower basic grades (1-4) from five schools, each school provided 20 students, 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 collect and interpret users' data and appreciate what real people need (Beyer & Holtzblatt, 1999). The purposes of the user evaluation to:

1. Measure the usability/practicality of the prototype.
2. Identify users' needs.
3. Identify strengths and weaknesses in the VM as well as ways to improve them.
4. Use the results of this evaluation to revise the prototype.

5.6. Data collection process

The goal of *this research is* to develop a virtual museum from the perspective of the participants for lower Basic grades as a tool of learning science in an informal environment:

1. Use evaluation instruments (Al-badawi, 2011).
2. Update the VM.
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. For example, on the Yes/No scale, a means rating over 1.5 was considered "satisfactory," and below 1.5 was considered "unsatisfactory," and over 70% was considered a satisfying domain.
4. Third and fourth grades students browsed the VM to complete the *evaluation instruments*; first, and second graders browsed the VM; the researcher and the teachers helped them complete the evaluation instrument.

5. Reviewed collected forms.
6. Hold the focus interview with students.
7. Analyzed the data.

5.7. A description of the data analysis

Chi-square test of homogeneity was used to provide statistical analysis of collected data and to identify significant differences (p-value) between user categories.

Data contained both qualitative and quantitative data. The qualitative data was analyzed with reading, grouping, and regrouping. The quantitative data were analyzed using the SPSS© quantitative statistical software program. Descriptive statistics and Nonparametric Kruskal Wallis Test were used.

6. Main field test results and discussion

6.1. 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, enjoyment, parent friendliness, integrating the technology into everyday computer skills.

Could the parents cooperate effectively to create a virtual museum as a tool of learning science in an informal environment? 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 Table 1.

Table 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 skills	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 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 the convention. *The appearance* was the highest satisfaction domain with a mean of 1.960. 84.24% of the parents found the *VM appearances was suitable*. The parents' evaluation test yielded positive feedback regarding the VM's instrument evaluation for revision domains. The parents found that the VM appropriation is appropriate. None of the domains have an unsatisfying rating; they have a mean greater than 1.5 and more than 70.00%. Out of 12 parents surveyed, 80.00% of the parents found that the *general software quality* evaluation was suitable, while 20.00% found it unsuitable. 80.00% of the parents found the *navigation* domain was suitable, while 20.00% found it was not. 80.06% of the parents found the VM was

enjoyable, while 19.93% found it was not. 81.00% of the parents found the VM *parent friendliness*, while 19.00% found it was not. 83.33% found the VM is appropriate to *integrate the technology lab into everyday life*, 16.70% found it was not. 83.35% found the VM helped the children achieve *computer skill's* domain, while 19.98% found it was not. 78.34% found the VM was characterized by STS standards, while 21.66% was not. Finally, 80.50% of the parents were satisfied with the *overall evaluation form*, while 19.50% were not. In the *content* domain, which was the least satisfactory, there are a couple of defective items: "familiar" (58.30%) and "well organized" (66.70%) contradiction that the children's results showed that the content was the highest satisfied domain as clarified later.

Q.2. Is there any significant difference in parents' opinions on academic qualifications (diploma, B.A, upper than B.A)? To answer this question, the researcher has utilized the nonparametric Kruskal Wallis Test. See table (2):

Table 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 skills	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 2 show that levels of significance over 0.05 indicate that the parents are similar in their opinion toward the VM concerning academic qualifications (lower than a two-year diploma, diploma, B.A, upper than B.A). The *overall evaluation form* significance value is greater than 0.05, so there is no significant difference in parents' opinions related to academic qualifications.

6.2. 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. Therefore, 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, enjoyment, integrating the technology into everyday life computer skills.*

The children were asked to act as experts and evaluate the system voluntarily. Using a simplified evaluation instrument, each child was given a copy of the VM, a letter of instruction, and the instrument of evaluation). 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 questions were answered to evaluate the usability and children's acceptance of the VM.

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

The means and the percentages of opinions calculated of the children to answer this question are shown in Table 3.

Out of 100 children surveyed, the results in Table 3 show that *integrating technology into everyday* life was the domain with the 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 life, while 7.45% found it was not. The content was the

Table 3. 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 skills	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

domain with the highest satisfaction, with a mean of 1.98. 98.00% of the children found the content was suitable, while 2.00% found it was not. The children's evaluation test yielded positive feedback regarding the VM's instrument evaluation for revision domains. Children found that the VM is appropriate. None of the domains have an unsatisfying rating; they 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 was not. 80.00% of the children found the *Navigation domain* was suitable, while 8.70% found it was not. 93.00% of the children found the VM was enjoyable, while 7.00% found it was not. 92.18% found the VM helped in satisfying Computer skills, while 9.38% found it was not. 91.52% found the VM was characterized by STS standards, while 9.14% was not. Finally, 91.86% of the children were satisfied with the overall evaluation form domains, while 8.05% were not. The content from the viewpoint of the children was accurate, precise, familiar, appropriate, well organized. The educational value is high and Easy to understand. 95.00% of the children said the content was familiar, 98.00% said the content was well organized.

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

Table 4 shows the significance levels over 0.05. They indicate that the children's opinions were similar according to the children's grades. The children's grades did not change the opinions of the children.

Table 4. 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 skills	4.055	0.256
STS* programmed characterized	2.210	0.530
Over all evaluation form *df=3	3.274	0.351

Suggesting that fourth-grade participants perceived the VM as a more significant opportunity to interact than first-grade participants, they are more satisfied. Regarding grades, 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. Therefore, they have been attracted to computers.

6.3. Over all children comments

The researcher regrouped students' comments as follows.

Several of the 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 in third grade said that it was beautiful, wonderful, and teaches us many things. Another one from fourth grade stated that the VM was "Beautiful and wonderful, Beautiful and very cool." Another one from third grade commented that it was "plain beautiful to love so much." Several students (14%) wrote about their hopes that this program will be available for other subjects like Arabic, English, Math, even History, and other subjects.

One from the fourth grade stated, "I hope that there will be a math and Arabic one like him," another from second grade "commented," we hope to get more subjects."

Several students (18%) gave various Several of the 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 in third grade said that it was beautiful, wonderful, and teaches us many things. Another one from fourth grade stated that the VM was "Beautiful and wonderful, Beautiful and very cool." Another one from third grade commented that it was "plain beautiful to love so much." Several students (14%) wrote about their hopes that this program will be available for other subjects like Arabic, English, Math, even History, and other subjects.

Between their love of science and learning about science through the program, it made them love science more, and that science is wonderful. The researcher commented that loving science is an honorable objective for nation success, and it might be the secret of the developed state's success. One from third grade stated that "the VM makes me love science more." Another from third grade wrote, "I loved it for science; wonderful science makes me love science more." The researcher thanked Two of the fourth-grade students who wrote about the photos that they are valuable and good.

Few students (5%) wrote that they enjoyed the scientific songs and films and games, one of them from second grade wrote "I enjoy films," and like Laghos' (2010) result that the children liked the colors and animations in the game.

The researcher acknowledged several of them, one from first grade wrote the following: "I Like everything, everything is a beautiful tutorial, we identify the parts of the plant that are sweeter, we learned how to grow the tree. We take information".

Others wrote that it helped them in the study and that it was better than the textbook. One of them from first grade stated, "We understand from the VM faster than the book."

6.4. Conclusions over all children comments

- Beautiful, wonderful, easy.
- Hope that schools or parents will provide it.
- Hope that this program will be available for other subjects.
- Made them love Science more, and that Science is wonderful.
- The photos are useful and good. In addition, they enjoyed the scientific songs, films, and games.
- The VM helped in the study. The VM was very funny.
- Interested in the computer, and identified sites, the eye, planets, solar system, animal.
- Enjoyed the compass construction of the museum.
- It was better from the textbook.

6.5. Focus group interview

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

The children's e-interview confirmed that the children were very excited about the use of the VM. For example, one of the children in second grade commented that it was the first time that he enjoyed such a learning task because he loved the game-like VM. Another 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 from fourth grade reported that "Although I have to spend much more time learning the scientific concepts, I think I

have learned better because VM allows us to explore and discover information. I like science through this program very much". Another child from third grade said that "Now I know different planets have different sizes, different colors. Jupiter is the most beautiful planet in the Solar System". An additional student from fourth grade commented, "Now I can visualize how the nine planets revolve around the Sun. I prefer to study science in this way than the normal traditional classroom teaching."

Another from second grade stated, "I enjoyed the construction part of the VM. That is a great idea for everyone to have a personal museum with his collection. I will do one."

Another from fourth grade stated that he could use the search engine more effective in gathering information; this encouraged him to search for information whenever he faced problems in understanding abstract scientific concepts.

The interview results indicated that the students loved the interactivity feature. The students also expected that this VM would be used in other science topics or other subjects. One of them from the third class commented that the VM was so exciting and enjoyable that more learning tasks would adopt this approach. They agreed that using games could make learning more fun. There hopes that this program will be available for other subjects like Arabic, English, and Math. The students interviewed also confirmed the difficulties they met in some subjects in science textbook-like Solar System, eye subject, one of them was an excellent achiever from fourth grade said that it let him learn better, especially about the eye and how the picture is formed in the brain. Another one from fourth grade said that he likes the part of technology very much. How camera functions look like eye functions, and how to do telescopes at home.

User evaluation found the confirmed significance of this technique, as parents' evaluation confirmed that the VM was satisfied. In addition, children showed a preference for using technology to learn about science, and they were much enjoyed the VM reading scientific information or as an expert.

More applications constitute evidence from this study that children preferred VM exhibits that include interactive entertainment like the results of Fuentes et al. (2019). García-Peñalvo and Griffiths (2014) advance and explore other different approaches to achieve the challenge of defining a very transparent framework in which both formal and informal learning are considered essential components of one's own person's knowledge base. Moreover, Griffiths and García-Peñalvo (2016) shown that these informal activities could be harnessed to strengthen the education system and that some of the methods of formal education would be applied to increase the effectiveness of informal learning.

The study results 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.

7. Result discussion Conclusions and recommendations

7.1. User test evaluation

The parents' evaluation test yielded positive feedback regarding the VM's instrument evaluation for revision domains. Parents found that the VM is appropriate. The parents were similar in their opinion toward the VM concerning academic qualifications. In addition, the parents were similar in their opinions toward the VM about their children's grades. So, there is no significant difference in parents' opinions related to academic qualifications. In contrast to Aristeidou and Spyropoulou (2015), it constitutes a significant criterion for using it in Lifelong learning.

The children's evaluation test yielded positive feedback regarding the VM's instrument evaluation for revision domains. Children found that the VM is appropriate. None of the domains have an unsatisfying rating; they have a mean greater than 1.5 and more than 70.00%. The children's opinions were similar according to the grade.

The contradiction between parents and children is that it is not necessary because the parents desired the children. The finding in this study showed that 95.5% of children found the VM was 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 and like Fuentes et al. (2019).

Children's 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 about using the VM, which helped them understand the subject content and navigate to search scientific information (Wishart & Triggs, 2010). As Sabbatini (2003), investigating the virtual museum stage and identifying the contents, functionalities, and approaches of the virtual museum, emphasizing reality. The researcher expressed her thanks to them. This study agreed with Pappa and Pannese (2010) provides a familiar environment for the latest generation of students.

The researcher confirmed that she would recommend working more, and she will design one for Math as soon as possible. As Lavonen and Villalba-Condori (2019) state, digital tools and environments in education are analyzed to prepare and implement the program and curricula. Aristeidoua and Spyropoulou (2015) demonstrate increased motivation and activeness. Explored new opportunities are being discovered and lead to new, more efficient directions. Fuentes et al. (2019) showed the receptivity to Tablets mainly by students and teachers, and parents.

7.2. Recommendation from user test evaluation

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

7.3. Recommendation

- 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.
- Investigate the effects of virtual museum projects on formal teaching programs.

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