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The Contribution of Cloud Computing in the Development of the Educational Process: A Practical Study in the Ministry of Education in Jordan

[1]Mutasam Okasheh, [2]Qasem Nijem, [3]Esam Salameh, [4]Hussein Maqableh

[2]Senior ERP Consultant, United Nations Office for Projects Services (UNOPS), Amman, Jordan

Abstract **- This study aims to build a comprehensive knowledge around reflecting the role and contribution of the cloud computing to the educational and learning processes in Jordan represented by the Ministry of Education (MoE). Through the features, concepts, benefits, and applicability of the educational and learning processes; an applied study in the MoE in Jordan was conducted to present learned lessons. Researches and studies have defined cloud computing as a collection of connected servers, which are centrally managed through local area networks or via the Internet. The cloud computing in today's world is a methodology that helps the educational process achieving its goals, enables the educational institution to save and analyze information based on its growing development, provide the staff of educational institutions with sufficient and backup information, and having the possibility of storing and exchanging information. Anytime, anywhere, and without the need of local computer power (to store, process, share and transmit information) cloud computing is a new model of consumption of IT services and a way of connecting these services to help the decision makers.**

This study aims to show how to employ cloud computing in the educational and learning process in the MoE in Jordan. The study goal is to reduce time, effort, money and cost, as well as enabling it to access data or information more quickly to achieve the specific objectives of educational and learning courses. It was made out clear here that cloud computing is one of the objectives of reducing the cost of educational work significantly, and emphasizes professional management of infrastructure. Therefore, it reflects on the overall performance of the educational institution and its performance development, and extends to our study and recommendations. proposed, and it is based on our relationship to the study and the proposed recommendations. All educational and learning measures in cloud computing are accomplished through external servers available on the Internet, while ensuring the security of information about the means of education, and keeping them from interfering and abusing viruses or hackers (hackers). The development of societies and nations is only done by the development of the education sector. If education succeeds, human resources (which form the backbone of any country) will succeed too, and the country will develop more as a result. Therefore, the educational renaissance has always relied on new methodologies (such as cloud computing, distance learning, data mining among many other technologies) to develop their economies, which are the main pillars of the prosperity and progress of the countries[1].

Some developed countries are racing in the technology and information sector to provide electronic services in the private and government sectors. Because the education sector is very important and areas of life has taken up a great deal of interest required for these countries in keeping up with developments and the revolution of information, technology and computerization such as cloud computing in the learning process. Communications and information technology systems have adopted their applications, such as the use of computers, software and the Internet, including most of the activities and areas practiced by individuals and institutions in the society. Because they achieve two important functions: expanding and speeding up access to any information, whether readable, audio or written, and its ability to become an active tool for the development of individuals' skills and mental and cognitive abilities[2].

E-learning (or distance learning) is one of the modern teaching methods in communicating information to the learner regardless of location and time factors. Modern communication mechanisms are used in the delivery of information to the learner within the shortest time, less effort and greater benefit and in a way that enables the management of learning process, and control, evaluate and measure the performance of learners. Cloud computing is characterized by modern technologies that enable enhancing and improving the required services and contributing to the desired goals[3].

Keywords: Cloud Computing, Ministry of Education, Jordan, Educational Process, Repository Model.

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I. The Problem of Study

The expansion of institutions and schools has led to the emergence of many IT-oriented problems, among other problems, in these educational bodies.

The most prominent of these problems is the need to retrieve data in an efficient way i.e. quickly and easily and to achieve more storage space.

For most of students, teachers, and related staff, the difficulty of controlling huge amounts of data, storage, sharing, and transmission has emerged as a result of lack of proper technology to deal with such huge amounts of data at the various institutions at MoE data.

II. Study Objectives

This study aims to clarify and focus on the contribution and role of the cloud computing in solving the problems of educational institutions in the MoE at Jordan and control the storage, transmission and sharing of data within statistical studies and the use of the model of improvement on the data repository [4][5]which was adopted as a reference model for the request and response of the required data.

III. The Importance of Study

The importance of this study lies in clarifying and demonstrating the contribution and role of cloud computing and its characteristics and impact on the development of the educational and learning process. Recommendations will be made based on the model adopted for Mutasam Okasheh after his master's degree thesis published in 2008 which was adopted at conferences and institutes in 2008and2009. The usefulness of the model will be explained for this study with the aim of decreasing time, increasing speed, and increasing the efficiency of the system in the MoE in Jordan, and these goals were reached for the researcher mentioned [6][7].

IV. Cloud Computing Concept

There are many definitions and concepts for cloud computing, but all of these definitions and concepts agree to a high extent that cloud computing is an infrastructure that contains huge number of servers, mass storage, transmission and sharing of data facilities. In this study the latter definition can be suggested as a comprehensive concept that cloud computing is an advanced technology based on the transfer of processing and storage space to the Cloud i.e. the Internet, which is currently called the “cloud”[8].

The cloud contains huge number of various kinds of servers (and platforms UNIX, IBM, Windows) that are accessed by the end-user as if they are one single server device via an interface. This server/s is accessed via the Internet to transform IT software from products to services. The cloud includes a range of resources such as networks, servers, volumes, applications and services, which can be quickly deployed to reduce time, effort, money and cost to improve the overall performance of the system in which it is operating [9].This can be explained by Figure 1:

V. The Emerging of Cloud Computing

The idea of the emergence of cloud computing began in the 1960s when John McCarthy noted that "computing may one day become a public service", and was the starting point of the earthly network[10]

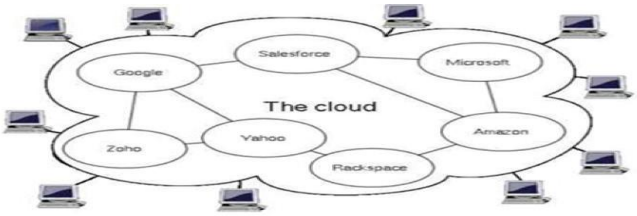

Figure 1: Components of cloud computing

Some examples of cloud computing: to mention but a few SkyDrive, Google Chrome OS, و Windows Azure. Examples of cloud computing applications: Pixlr Editor, GoogleDocs, and Jaycut.

VI. The Advantages and Disadvantages of Cloud Computing

In the following paragraphs the research will display pros and cons of the cloud computing paradigm to reach a clear picture on how and when to use it such new technology and to realize its advantages and disadvantages in the education sector.

The advantages of cloud computing

High ease and flexibility when performing tasks, thus facilitating the work required.

The cost of utilizing cloud computing services is much lower than the usual processing and storage tools, aswell as the ease of providing software.

The speed of joining with modern technologies on the Internet, and the following possibility of linking several websites such as social media.

The disadvantages of cloud computing

Reducing the storage capacity based on the cloud provider request.

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If the cloud provider is malfunctioning, stored data is unreachable until the server is restored.

Risk of data confidentiality and the weakness of the Terms of Agreement of the website concerning the protection of the user's rights (security and confidentially of user's data).

Not all applications can run on the cloud environment and some of them do not work well under low-speed connections.

The cloud computing environment causes more pressure on the Internet due to the increase in the number of copies of the same data on more than one cloud. Since the applications via the internet, the loss of connection will result in the inability to perform the work and such failure will affect the completion of the work.

Security and confidentiality concerns: some users are afraid to put their information on the cloud services providers because the cloud-based services are exposed to penetration operations and consequently hackers may be able to obtain the information of the users. Fears that non-authorized staff may share their personal information.

Cloud applications: have not yet reached the level of the traditional desktop applications in editing documents online like Microsoft Office, but are gradually approaching this in time.

Reliability: when the user deletes his files, nobody is quite sure that they have been deleted completely physically from the storage.

Performance: slow internet speed is a problem that faces users in the developing countries due to weak infra-structure.

VII. Challenges and Difficulties of Cloud Computing at the Educational Sector

Cloud computing faces many risks due to its novelty. Since the service provider, in the case of developing countries like Jordan- is available outside the country, this situation increased the possibility that the service provider or the source of this service may not follow exactly regional laws which makes these concerns more acute. But some bigger challenges are still there for the MoE as below:

The biggest challenge facing the ministry is maintaining the data confidentiality and security.

Data control: when MoE adopts cloud computing solutions, it will become under the mercy of the service provider, which may cause some troubles once the files and data are activated.

Convincing the administrators and decision-makers of the feasibility of adopting the cloud computing because of its advantages in term of providing single point of data access. And the need for large computer storage for the files of the ministry in case of not adopting cloud solutions.

Consistency, reliability, and Service Level Agreements for mutual understanding about the Quality of Services provided at the MoE.

The need for comprehensive coverage for fast access to the Internet and the availability of appropriate applications for all institutions and their economic viability [9].

VIII. What is the Future of Cloud Computing and its Role in the Education Sector?

The future of cloud computing, certainly not in a year or two, will reach to the point where all operating systems will be transformed into cloud systems similar to Google Chrome OS.

Google has started this line early, as experts predict that the size of the cloud computing market will reach nearly 150 billion in the second decade of 21 century as a result of the inevitable adoption of solutions for this technology in the world of finance, business and commerce. The Cloud Computing that we will be dealing with in 2020s will be somewhat different from what it is now.

The software is increasingly becoming independent from the hardware and equipment environment, so that it is programmed to be operational on any device regardless of the manufacturer. The same software will be transformed into a range of independent services linked to each other by special techniques to perform the required tasks. This development will make digital computing generally look invisible. Most of the operating systems will be transformed into fully or almost completely cloud-based systems.

We will get to the point where we can run all applications across the web, and even the biggest computer games. Cloud computing technologies, web applications and internet speeds are developing rapidly and soon the cloud will dominate everything and possibly closer than we imagine. For all these reasons, the software will be written in the form of modules capable of operating freely and independently of the rest of the program that was written as part of it. Currently there are some applications that can develop software such as Android Studio and MIT's Application Inventor [11].

IX. Test Cases for the Study Proposal

In this study, a comprehensive proposals and recommendations will be presented as recommendations for

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developing the educational and learning process in the system of MoEin Jordan. In this study, researchers will rely on two tests: The first is a statistic for the MoEin Jordan where a sample was taken from the Education Directorate of Jerash Governorate. Whereas the second test is the application of the global improvement model to the data warehouse model (Enhancement on repository model on software engineering) published 2008 [5][7].

This researcher presented the proposal in this study, and since the optimization model used as a software verification tool is a system that depends on storing a copy of the data obtained from the central database in the buffer instead of going each time to the central database. Whereas, the Buffer is characterized by fast access to data and its size is proportional to the size of the data that will be stored in it. This in turn has led to an increase in the overall performance of the system (as shown in the research papers published in the references mentioned above), and provided solutions to the delay in demand and response to data, and to solve the problems of time, speed, production and achievement of the system in general as it was in the form for[12], "Shared repository pattern ", and as the optimization model used as a software verification tool, Which uses the following applications and programs.

Oracle Enterprise Manager Software[13]

Insider 2.1 software.

In order to verify and prove the proposal of this study to be applied to a sample school (Al-Mosherifeh Secondary School for Boys), the data in this sample will be compared with the data that will be obtained after application and verification using the programs mentioned above to reach improvement in the system of the MoE which is represented by the following:

Observing the extent of improvement in the overall performance of the system,

Increasing its efficiency,

And improving dealing with data with demand and response, saving time and effort.

This is to be an indication of the efficiency of the system and the reliance on this model in our study of the current proposal to build an integrated knowledge system for the system of the MoE in Jordan.

With a note that guiding the improvement model and explaining the great benefits that it produced at the level of large systems, it is worth referring to the model and there is no need to apply to institutions, schools and education directorates to prove its effectiveness because the above-mentioned improvement model is proven and published and approved globally, and it can be used in any programmed computer system

Implementation of the proposed tests:

First test

The first test: a scientific study was conducted through a statistical questionnaire in the educational institutions of the MoE in the Directorate of Education in Jerash Governorate, regarding the contribution of cloud computing to the development of the educational and learning process in Jordan where samples were taken from the educational community and schools of Jerash Governorate. A simple scientific study based on personal interviews in higher education institutions.

The study concluded the following results:

First test results:

Spending on public cloud-based services will grow by more than five times the rate of growth in IT spending during 2017, an increase of 30% compared to 2016.

The spending on services based on the cloud computing used in the MoE will witness a growth rate of more than three times the rate of financing spending on the IT sector during 2017, an increase of 30% compared to 2016.

Building a private building for information systems requires huge sums that may be an impediment to development.

Energy consumption as the suffering of educational institutions such as schools and education directorates in the Kingdom of the plans of digital development is clear-cut. Cloud services.

Virtualization Cloud increased by 72%, to enhance the presence on the Internet and increase confidence in the system.

Second test

In the second test in the) proposed model a simulation tool will be designed to achieve ideas for the proposed approach to verification and enhancement, so we will develop our application from two sides: the first is the server side and the second is from the subsystem, where we can use the Oracle application server or SQL server 2000/2005, to complete the techniques of each one installed on MS Windows Server 2003, and we can use forms. NET or Oracle to complete the client (subsystem) side application [13] .in this section, we have described and explained the new tool that will be used to

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support the main objective of our approach to promote the update of the warehouse model where we described the main structure of this method and compare this work, and previous studies in this area. On the server side we decided to use the Oracle application server because it supports all things that will be used in the process of developing our application from the speed in implementing any DML statement such as selecting, inserting, updating or deleting where the speed of implementation of this data is a triple of any other database server such as the SQL server 2000/2005 (from Microsoft [13]).The proposed algorithm is a phase description algorithm, we will focus on the most important steps (database repository) that will be summarized as - View the size of the buffer. Through the shared pool repository.- Through the buffer log.- Use the pool that represents the cache.- After we have analyzed the storage system, we can make the following decisions to improve performance:- By automatically scaling the buffer space [10]. Next, we can find the output based on the following software packages.

Oracle Enterprise Manager Software [13].

Insider 2.1 software.

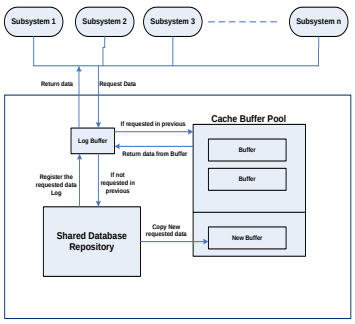

Figure 2: Repository model after the Enhancement [5]

Some of the following figures follow to the Using Enterprise Manager to Configure Automatic Shared Memory Management in performance respectively:

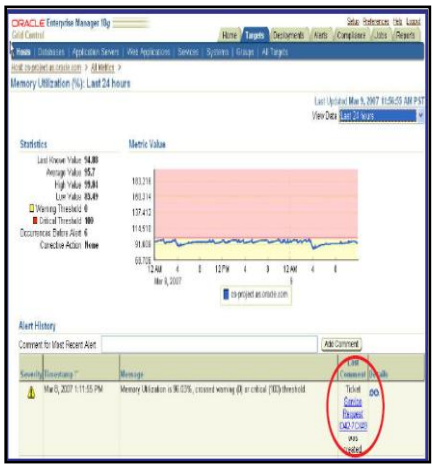

Figure 3: Enterprise Manager [12]

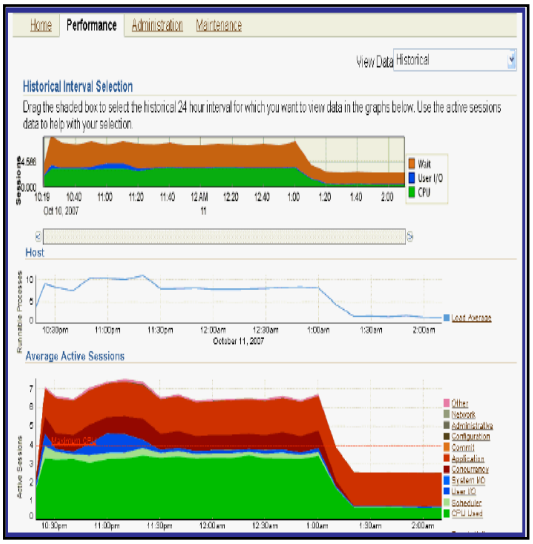

Figure 4: Historical Interval Selection in Performance [5]

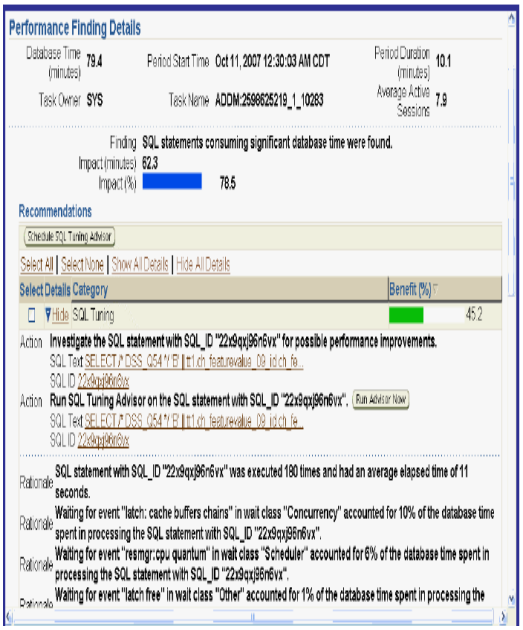

Figure 5: Performance Finding Details [5]

Figure 6: to be named

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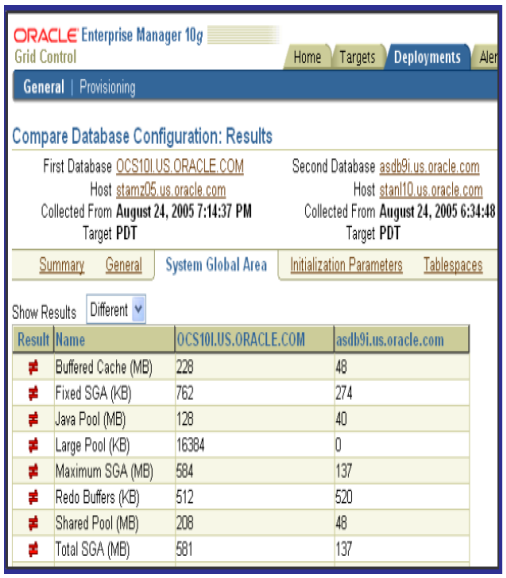

Result	Name	OCS10I.US.ORACLE.COM	asdb9i.us.oracle.com
≠	Buffered Cache (MB)	228	48
≠	Fixed SGA (KB)	762	274
≠	Java Pool (MB)	128	40
≠	Large Pool (KB)	16384	0
≠	Maximum SGA (MB)	584	137
≠	Redo Buffers (KB)	512	520
≠	Shared Pool (MB)	208	48
≠	Total SGA (MB)	581	137

Figure 7: Compare Database Configuration: Results [5]

Figure 8: The Collaboration[5]

Figure10 shows the relation between queries and times about response time in Philippe Lalanda study, (Comparison between Philippe Lalanda[12]:

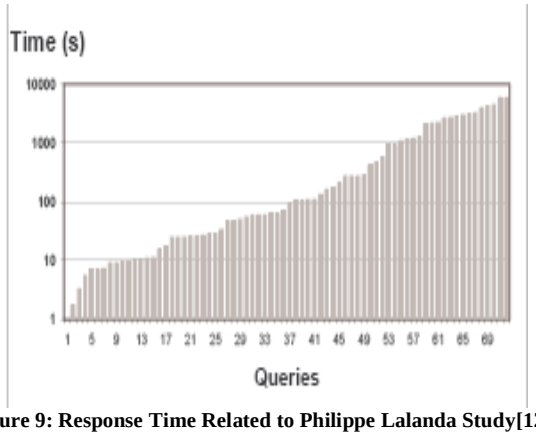

Figure 9: Response Time Related to Philippe Lalanda Study[12]

Figure 11 shows the relation between queries and times about response time in this study[4][5]:

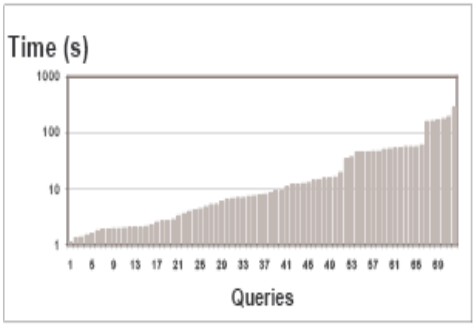

Figure 10: Response Time Related to proposed study [5]

Table 1 : Comparison of results between Lalanda and propsed study[5]

Researcher	Average Response Time	Maximum Response Time	Cumulative Response Time
Philippe Lalanda	817 second	5751 second	58821 second
Proposed Study	30 second	275 second	2131 second

Note: Best Case and Worst Case

In this part will describe briefly what are the best and worst cases of my application tool:

The best case will be done when all subsystems use the same data so that for all subsystems there is just one buffer will be created in the server side.

But if each subsystem uses different data, so that the server will create different buffer for each subsystem where we can say it is the worst case.

In the best case, Table 2 describes the advantages and differences between proposed study, and Philippe Lalanda [12].

Table 2: Differences and advantages between proposed study and Philippe Lalanda [4][5]

Subject	CPU	Disk	Database	Time
Proposed Study	Less	Less	Less	Less
Philippe Lalanda	More	More	More	More

SGA principles that can be used in Oracle database has been tested with three workload setting criteria: Low, Medium, and High, as described in Table 3. Transactions have been executed by each user independently and simultaneously

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against a single CPU P-IV 1.8GHz/512 MB of RAM, on Personal edition Oracle 10g database server.

Notice that the size of data in the all buffers might be equal to the size of data in the central database, and there are several conditions to be considered while comparing this study with Lalanda study to measure the performance as a whole:

- Size of requested data.
- Type of requested data (same, different).
- Number of requests the data.
- The start time of requested data.

The deletion of the data in the buffer in general occurred when the server make restart, so the buffer became clean from data.

These transactions, containing a mixture of SQL commands such as INSERT, UPDATE,

SELECT, and DELETE, shows the transactions between the users, and the execution time in three cases.

Table 3: Workload Criteria[4][5]

Subject	Low	Medium	High
Users	2	5	13
Transactions	12000	19500	43000
Exec. Time	1h00	1h15	2h00

It was noticed from the implementation of the "improvement model", improving the response time and increasing the speed in the demand and response of the data and thus increasing the overall performance and efficiency of the system, increasing the production of the system, and increasing profits, as mentioned in the study. [4][5]

In this paper, a common database problem occurs in the data warehouse model when there is a subsystem request for data from the central database, and then there are some problems to access data such as consuming a long time to obtain data in the case of multiple requests from other subsystems at the same time, as it consumes higher cost, less speed to obtain data, but when large amounts of data to be shared, the warehouse model uses sharing Most commonly our system to enhance the first method of inventory model, if there is a subsystem requesting access to shared data, then it will take sufficient time unless another subsystem requests from the shared database, we put the data in a buffer zone which is like buffering used to store the data needed by the first subsystem, then the joint database responds to the request of the other subsystem and begins to respond, in case the other subsystem request sought the same data that was first requested to them, and stored them in the buffer zone, so they can be accessed directly on the buffer and without the need to create another [5][4] buffer.

The proposed model was simulated, and the results showed its ability to reduce data access time, increasing data access, increasing system performance, and increasing system efficiency.

The proposed model was compared against the "shared repository pattern[12]" and the results showed that the "proposed model" performed better by reducing data access time and speed.

The MoE in Jordan should improve the computing literacy levels employees of the software concepts, set up programs and training courses and measure the effectiveness of.

Finally, in this study we presented two tests of the proposed model and presented the results of the first test. Next, we applied the sample model of the statistical community (at the secondary school for boys). In the second test we applied the global model of improvement on the data repository where access to data efficiently through cost improvement, reduce time[5],and increase the speed of data sharing between these Subsystems. Consequently, we can take advantage of the proven model (software tool), which we used as a software tool to demonstrate and improve in the request and response of data, to prove the proposed model referred to in Figure 1, which accelerates the work and achievement in companies, so the overall performance of the MoE in Jordan improves, leading to increased production of the Ministry, increased profits, and increases activity and excellence of the Ministry, and this is the goal of this study.

X. Proposals and Recommendations

There is a set of proposals and recommendations that represent the objectives, guidelines and benefits of using cloud computing in the educational process applied to the MoE in Jordan, which we reached in this proposed study:

1. Access to data and applications from any place or school belonging to any branch or directorate of the directorates of education under the MoE provided that there is internet service.
2. Cloud computing provides the user such as the teacher, student or manager of any department under the Ministry of Education, and the preservation and backup of data and information, and the possibility of processing information remotely related to the creation of files or modifications to them such as deletion, addition and preservation, which leads to the ease of retrieving information from any place

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where the internet is available, saving the user such as the teacher and The student, the manager, the staff, the entire educational staff, the cost and time and the production increases, especially using the second test used in the test of this study by designing software using programming languages such as Oracle and c#.net to be able to store data in large databases and easy retrieval of data using software designed to activate the role of buffer.

3. There is little need for technical support and maintenance within schools and education directorates of the Ministry of Education, so the user will be excluded from purchasing software licenses and providing self-service on demand for data.
4. The process of sharing information between users and staff of the MoE staff, and the ease of circulating this information and transmitting it over the Internet, regardless of the size of that information transmitted and the forms of its files, as well as the lack of cost in physical equipment (Hardware),)as well as the time, effort and money and speeding up the completion of transactions as well as the property of file sharing reduces the storage space and also does not need the directorates of education and the ministry itself to allocate a place for the devices that manage the work and thus reduce spending where the ministry does not need to buy huge servers.
5. Enable positioning of high-resolution sources provided and resource control: examples of storage, processing, memory, and network properties.
6. Cloud computing provides teachers, students, teaching staff, and users outside the ministry's teaching staff with tools of creativity, innovation and participation in interactive processes between the elements of the learning process, which improves educational performance[14].
7. Flexibility, Sustainability, scalability and ease of implementation, maximizing IT capabilities, saving and reducing costs, and measurability which saves a lot of students and staff time, develops the learning process such as people's study management, setting up and preparing study schedules and distributing them to the tide, testing systems, evaluation and guiding the student to proper e-learning.
8. Help the Curriculum Development Department develop modern curricula in Jordan and strategically develop the implementation of classes and evaluation, leading to an increase in the level of students and teachers.
9. Increasing the effectiveness and interaction of teachers and students, and increasing the number of successful students in high school, which increases the possibility of admission to public and private universities.
10. Cloud computing has become an urgent necessity and will be an essential and important component of the learning process in Jordan, such as the preparation and design of manual and electronic courses, the management of classroom people on teachers, evaluation, exam system and all that matters to the teaching and educational process.
11. Educating communities and parents of students using cloud computing as a modern technology to jointly develop the learning sector in Jordan.
12. The impact of the presence of the cloud on self-learning in the MoE and at teachers and each teacher submits his data and organizes it in its own files and then uploaded to the ministry's website via the cloud.
13. The impact of the presence of the cloud on self-learning and its impact on the student in the development of his creation.
14. Its impact on evaluation and the use of strategies includes:
15. The teacher prepares, organizes and uploads files
16. Each teacher is able to read and modify his data in coordination with the program manager or liaison officer.
17. Continuous evaluation and review, ground-based nutrition, educational plans, educational standards, and the use of previous mistakes, in line with the ambition to achieve educational goals in the MoE in Jordan.
18. The cloud connection to the Internet helps researchers and students.
19. Benefit from online distance learning such as what was done in the educational and learning process in Jordanian public and private schools during the period of disruption of the direct teaching process and the disruption of schools during the Corona pandemic from 17-3-2020 to the time to come.
20. Use educational applications to facilitate downloading materials and educational content on them, such as these applications Noorspace, darsak platform…etc., making it easier for students to access information at any time.
21. Reduce the costs of publication and publishing resources to educational institutions through a single and unified educational content that all parties in the educational and learning process can access.
22. The possibility of predicting experimental test content (experimental tests), such as pilot tests for orientation examinations (high school) on the month of 6 2020, and can be developed for a question bank.

XI. Summary

The employment of cloud computing in the Ministry of Education, its institutions, directorates, and schools helps to reduce the cost, reduce time(reduce the time),and increase the speed of sharing data between these subsystems, in the strategic planning of in the administration of the MoE to the success of the educational and learning process, from In setting the objectives of a set of objectives long-term strategy, focus, analysis of procedures followed, effectiveness and training of the ministry's cadres in the use of cloud

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computing in their work to improve the performance of the Ministry and its institutions, in order to serve the educational and learning system as a whole. Therefore, cloud computing (electronic cloud),is an effective tool in the educational environment.

In this study, we presented recommendations based on two tests: the first is a statistical study of a sample of the educational ,community, represented by the MoE and the second test is based on the model adopted globally for the researcher(Mutasam Okasheh),after a bulletin of master's thesis and international research papers, and, was adopted The same benefit will be explained for this study with the aim of time-consuming, speeding, and increasing the efficiency of the system, [5] and these goals have been reached with a[4] posted master's letter to the researcher mentioned above. We have been utilizing, using and relying on the globally published data repository optimization model, where we have shown how to access data efficiently by improving cost, reducing time, and increasing the speed of data sharing between these subsystems that require data.

This study referred to the clarification, statement and contribution of the computerized cloud in the development of the educational and learning process, and the model for data improvement, a model that has been proven and adopted e globally we present as a proposal to be used in the design and development of technology and the important data in the databases, so that the vast amount of large data databases of the MoE can be archived and stored, and the possibility of retrieving and requesting data and responding to demand, with the least time, and by any time. At the time you want, and at high speed, which leads to increasing the efficiency of the system of the MoE in Jordan, thus accelerating the achievement, and increasing the efficiency of the MoE in Jordan, which contributes to the development of the educational process and learning, thus developing and improving the most important sector of the government which is the MoE which is concerned and contributes effectively in the upbringing of future generations of students and teachers, and enable the teacher to develop himself, knowing that it is the basis of the educational process and the main pillar.

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