The Effect of Applying Software Engineering Principles on Web-based E-learning platforms Development Process

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Abstract: Recently, E-Learning had been concentrated all over the world to achieve better educational experience. In Libya, e-learning now, in the improvement phase, so that, e-learning platforms development should be focused. In this study, the effect of software-engineering application to the platforms based on web for the educational purposes. The Platform is implemented using HTML, CSS, PHP and JavaScript., by MYSQL, database is designed, based on Incremental-model, to investigate the effect of platform development based on Software-Engineering on the performance of students. This would be implemented by analyzing data by SPSS, data would be collected form secondary school in Libya through a questionnaire, the number of study population was (20) students and (20) teachers. Results have presented that developing platform based on soft-engineering could improve the students' performance, however, other factors should be taken into consideration to develop the entire e-learning system and take advantage of the software-engineering application to develop e-learning platforms.

Key words: Software, e-learning, students, platform

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1. Introduction

In the modern era, Improvements in computers and the internet technologies are fostered the e-learning growth. E-learning is essentially the network-based system to transfer knowledge and multiple skills (Nyirenda,2019). This had offered opportunities and liberty to define when, how and what we would learn. e-learning is characterized by the low-cost, capability for interactive, accessibility for 24 hours over the week, It could offer affordable and suitable opportunities for development the career as well as skills(Kattoua,2013). E-learning should provide educational environment that permits interacting knowledge building. thereby, the cost of offering education would be obviously low. Electronic Educational represents an inventive shifting in the domain of learning, offering fast access to particular information. E-learning provides instruction which could be delivered anywhere and at any time depending on a several electronic educational solutions which are web-supported. Because electronic educational override distances and gaps of learning institutions, it offers a coherent virtual educational environment that could really make a variance in the delivery of better learning. E-Learning based on computer systems are considered very complicated developments due to the projects nature might include several roles, actors, contents, services and functionalities(Dodero,2012). The fail of several initiatives related to instructional-design is usually attributed to weakness of instructive design, the present designs do not offer more insight into designing processes to create instructional Solutions for learning. due to similarities among the domains of instructional designing and Software-Engineering. due to similarities among the domains of instructional designing and Software-Engineering, designers of learning sites could employ the principles and ideas associated to Software Engineering to enhance their solutions related to designing process. Software-Engineering methodologies could be employed to evolve powerful electronic education solutions (Adnan,2018). rather than concentrating on theory of learning and concepts which are only related to instructional designing, designers might profit from the principles extracted from the Software-Engineering.

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2. Literature review

Educational design which includes digital forms of learning and teaching requests an accurate balance among design and technology to offer a more stimulating, catchy, and efficient educational experience (Molenda, 2008). Thus, designer has an essential role to connect between those domains. Technology advancement made developing electronic learning process more complicated rather than be easier (Spector, 2001). Moreover, majority of educational models head to create novel modules instead of constructed based on components which are reusable (Fuente-Valentin, 2011). design e-learning site is a framework for the designers to make analysis the educational contents, then apply the convenient model to obtain the wanted learning results (Ritzhaupt, 2015). (Gustafson, 2002) thought that powerful instructional models, principles and theories, could lead to enhance learner performance. The (ADDIE) model {Analysis-Design-Development- Implementation-Evaluation} is an outstanding instructional designing method. However, several practitioners and researchers think it might not be a convenient methodology to evolve powerful instruction in the classical education and the electronic education environments.

2.1. E-Learning

It is the educational system depending on official teaching integrating with the electronic-resources, it is the education which is supported via Information-communication-techniques (ICT) to make users able to learn from anywhere at any time (Ametova,2020). E-learning could be also named by distance-education, digital Learning, web-based learning or virtual learning (Williams, 2015). There are basically four types of E-Learning that are shown in the following scheme in fig (1).

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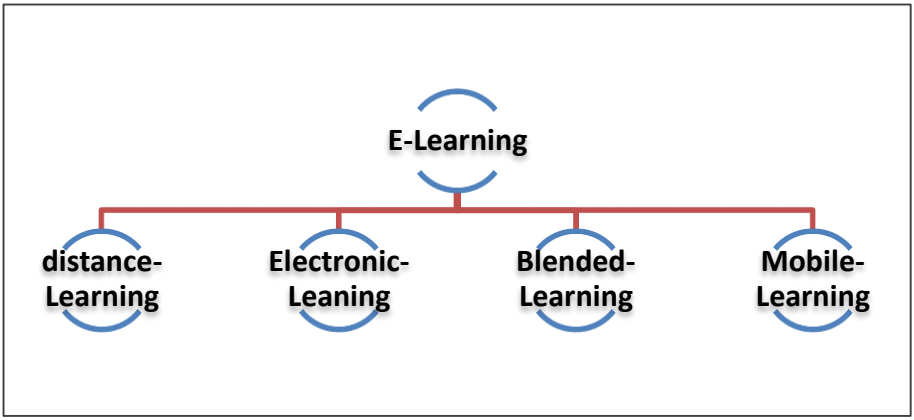

Fig (1): E-Learning Types

Many benefits could be obtained by e-Learning such as (Guragain,2016):

- Suitable for learners: due to the ability to access at the time that user wants, no need to be exist physically in the classrooms. Additionally, Learners could download the educational materials and save them for the future targets.
- The cost is lower: Electronic education is cost-effective for learners; they could select from wide range of electronic sources based on their requirements.
- Updating the electronic resources frequently: materials could be modified easily without changing the entire materials.
- E-Learning offers the possibility for learners to learn the material frequently.

Despite that, several disadvantages associated to e-Learning systems such as(Stroud,2015):

- If some learners have weakness motivation, they might not implement the set aims because, there is no supervision, and they would be responsible for organizing their course.
- Studying process is implemented based on computer and learners might have not the enough skills to use these applications. additionally, connecting with the internet might be poor.

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- Lack of sharing classmates might impact on the learner's performance.
- For specific materials, classical education might be better than electronic one.

2.2. E-Learning in Libya

Using Internet has been obviously increased in Libya since (2000), according to (Porter,2008). Libya seeks to achieve the standards highest-education in the other regions to compete them. The number of people who use the internet in Libya reached about 5.86 million users from the total population (6.73) million in 2020(Mwakideu,2021).

2.3. Engineering-Software

Software Engineering (SE) is a section of engineering that employs Computer-Science and other sections of engineering as well as science to provide people a methodology to construct software, in a method that guarantees the goodness of the outcome product and completed of the building task within prospected estimates of timetable and cost (Papaspyrou,1999).

(Amelia,2018) discussed the hardness in understanding the courses related to Web-Programming which leading to low results, thereby, it is necessary to evolve and improve the capability of learners, therefor, author had proposed to design Learning-Management System based on E-Learning for the materials associated to Web-Programming.

(Ahmed,2015) had presented an instructor model for e-learning to be adoptable in Pakistan, also a survey of learners had conducted to specify the conditions of local education and student's profiles as well as the individual education styles. Results had presented that the proposed methodology had proven affirmative on students' learning and the rate of failure had decreased.

(Elameer,2019) studied an electronic platform which is designed according to the requirements of universities in Iraq. Based on ADDIE model, platforms are implemented and the problems of design are also solved. Results had shown how the electronic system for managing the content are integrated with the social-network,

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platform also contains multiple presentations and various forms of learning content for each kind of several courses.

(Hamzah,2023) aimed to establish a proper electronic educational development approach for the Al-Balqa'-Applied University that depended on Moodle as main electronic educational system. Author had mentioned that an education managing system is more important for both educating and learning process, therefore, due to the technological enhancement, E-learning systems become criterion in each country.

(Chiriac,2019) aimed to build an E-learning based on web technology to raise the quality in higher Education and he had mentioned that learning process now is changing continuously due to the technology improvements. therefore, learning technologies are also extending. Changes that resulted by universities, course contents, quality guarantee and educational command should be considered in the evolvement of E-learning for meeting their requests.

(Hariyanto,2020) this research had evaluated the adaptive E-Learning based on Web with expert's assessment. Evaluation process had begun by evolving the evaluation tools through taking into consideration some literature that is related. the content veracity of tools had checked based on experts.

(Lestari,2019) had conducted to search on other resources which could be the base and reference in making applications of E-learning.

3. Problem statement

Several challenges are facing e-Learning in Libya such as lack of skills that associated to technological applications and devices as well as Failure to attend courses regularly, and other factors. Therefore, a powerful electronic educational platform should be design to meet the requirements and find solutions to overcome these challenges. Depending on software engineering principles, an e-learning platform would be designed to evaluate the performance of student's improvements.

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4. Aims of this search

This study basically aims to explain the conception of designing electronic educational platforms depending on software engineering principles and study the effects of the proposed system on the performance of student's improvements as the following:

- Investigating the impact of applying software engineering principles on the development process of web-based e-learning platforms.
- Identifying best practices and guidelines for incorporating software engineering principles in web-based e-learning platform development
- Evaluating the benefits of applying software engineering principles in web-based e-learning platform development

5. Research questions

1. What is the requirements that e-learning platforms should provide to both learners and teachers?
2. What is the effects of e-learning platform design on the performance of students?
3. What is the effects of e-learning platform design on the performance of teachers?
4. What is the benefits of applying software engineering principles in web-based e-learning platform development?

6. Methodology

In this work, two basic stage should be implemented:

1. Design an e-learning platform: The Incremental model would be employed, software evolvement process, the various requirements would be divided into several modules that are standalone. In the proposed model, every module is going through the demands, design, application and examining phases. Each next release of the module inserts function to the prior release, this process carries on until the entire system is

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implemented (Pressman, 2001) This approach is characterized by generating software rapidly and early through the Life-Cycle of the software. This approach is not costly and flexible for changing requirements and scopes. It is easy to test and correct through a smaller reiteration and easier for risk management because dangerous pieces are determined and handled. Incremental method is useful where requirements are clear and can be implemented in phases (Sommerville, 2011).

2. Study the effects of the proposed platform on learner's performance: this would be implemented by a questionnaire to evaluate the students' performance as well as teachers.

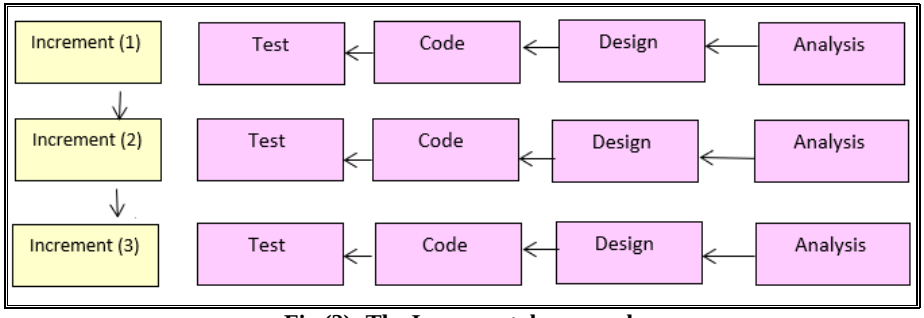

Fig (2): The Incremental approach

There are various strategies to create a system for e-Learning. the electronic system for e-Learning based on web includes the five modules as following:

User's dashboard, attending lectures, notes download, assessments, as well as alternative, the educational web has a user-amiable interface for users to react with the system that enables instructors insert details of learners, save questions of assessment, manage assessment in addition to generate results of student, and reports that could be printed to ensure rapid feedback. The Admin has the prerogative to make questions and cancel them, add accounts and delete them, in addition to view rankings and assessments that are offered to students and the comments of users.

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6.1. Design the system

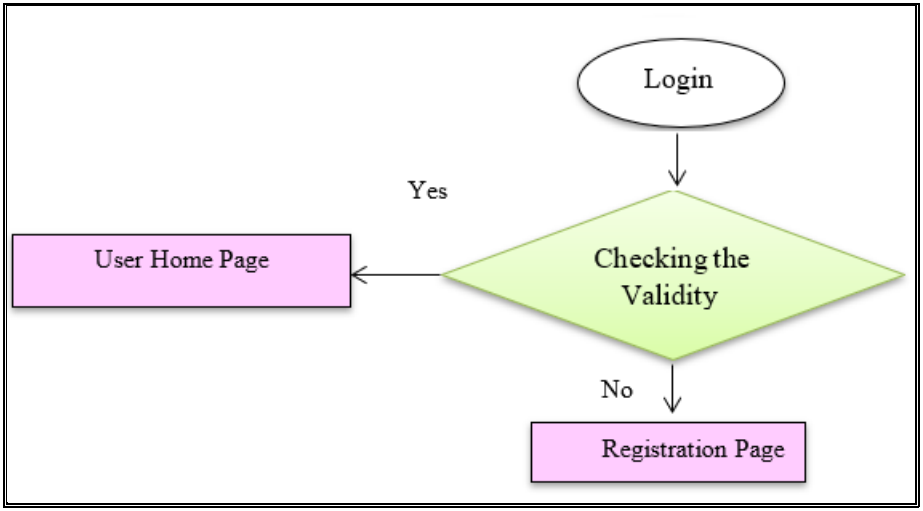

Fig (3): Flow-Chart of E-Learning based on Web

Based on Software-Engineering Principles, the system would be subjected to recurrent evaluation as well as revision.

- Requirement stage is the process that needs of user in a software web are specified and modeled as well as validated.
- Analysis Stage: is when the basic information to design the novel system is provided. It determines the objectives of the system and its limitations with that designers should comply.
- Design Stage: when structure is established, this stage begins with documentation that is delivered through the analysis strategies, requirement, as well as integrating the requirements with the architecture.
- Testing Stage: the implementation stage copes with quality issues, performance, libraries, baselines, debugging.

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Applications of e-Learning integrate content with technologies of learning systems for backing content creation and provide it to students.

Fig (4): E-Learning based on Software-Engineering Platform

6.2. Requirements of Software

The requirements of the proposed e-Learning platform specify the abilities and performances which the system would provide. The requirements are employed to lead the design of particular deliverables of system as well as assessment if these deliverables are acceptable for the meant purpose, the requirements are summarized as following:

- Admin would have the ability for managing the courses, users, learners, levels, contents and lecturers.
- Teachers would have the ability for managing classes, sending messages and receiving messages among the learners and other instructors.
- Send Link to meant class by notifications and downloads managements, assignments, announcements and quiz.

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- Students would be capable to view their class, notifications viewing, view the education materials and download them, that include audios.
- Learners could be taking questions of quiz at any time they would be ready.
- Admin would have the ability to create accounts for new users and add them to the educational system.
- Admin would have the ability to view the entire assessments and students' results, performance as well as feedback on students' performance, recommendations, and interventions.
- Users should have the ability to login to the platform by using usernames, in addition to passwords.
- Users ought to register students in their classes by inserting their details
- There is necessary to upload tutorials and notes for students.

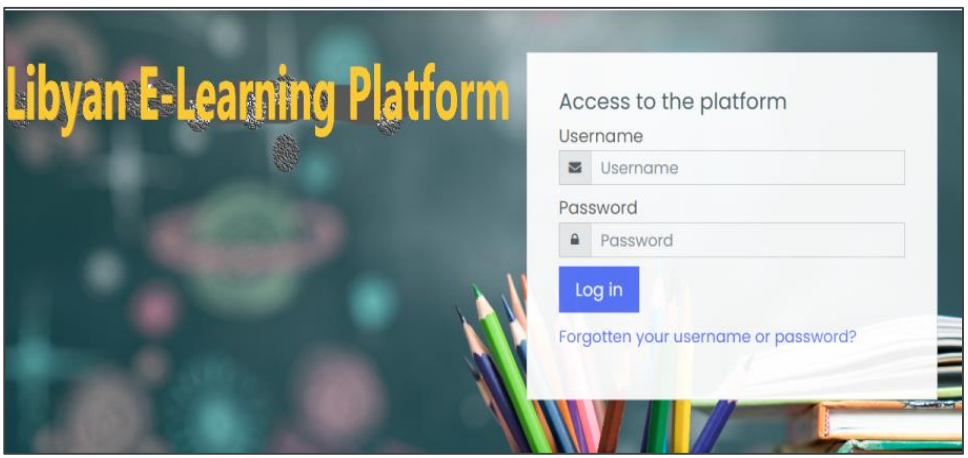

Fig (5): the ability to login to the platform by username and Password

In General, it is difficult for a teacher to prepare and present courses by e-Learning. thus, it is necessary to develop a simple system.

Designing the materials for E-Learning requests curricular commitments considerations, available evolvement materials and tools. however, it also requests

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accurate analysis of techniques associated to learning and teaching. The design of modular should simplify designing courses and providing scripts, tutorials, richness, interfaces as well as flexibility for classes. It also should provide teachers the ability to improve, interrupt, and provide instructions according to a specific time order.

Modular structure consists of a basic framework integrated with the needed modules, information-systems had become an essential part of a learning process.

Educational institutions require to earn more with small costs based on their investments in the field of IT. The modules could be optimized separately of other modules, if one of modules is failed, then it does not lead to other fail modules.

The results of an e-learning platform development would help Libyan school to create a good functioning electronic educational system which aims to improve student performance despite of different challenges. This system is implemented using HTML, CSS, PHP and JavaScript. To design database, MYSQL is employed, and based on Visual basic tool.

6.3. Data collection

In this research, population study includes students and teachers in a secondary school in Libya (20) student and (20) teacher. The needed data would be gathered depending on a questionnaire that consists of items to determine the impact of using this platform on users' performance. Five Dimensional Likert-scale is employed to formulate the questionnaire items.

7. Result & Discussion

The following table shows the Statistical results of the impact of the proposed platform on students

http://dx.doi.org/10.29009/ijres.8.1.3

Table (1): Statistical results of the impact of the proposed platform on students

No.	Items	Mean	S.D.	Grade
1	Features of the proposed platform enhance the performance students	3.69	0.91	8
2	Proposed platform provides flexible performance and ability to be accessed through various devices.	4.18	0.868	2
3	The proposed platform proved that it is simple to use and interactive, therefore, no need to have special computer skills.	3.97	0.92	4
4	There is communication between students and their teachers	3.91	0.93	5
5	Students will be committed to attending and following the lessons on the platform	3.87	0.819	6
6	Platform improves obviously the students' performance	3.79	0.847	7
7	Lack of internet could be a challenge for students.	4.02	1.112	3
8	It is easy to use interface that enables learners and instructors navigate easily through the different modules	4.26	0.909	1
	Total	**3.96**	**0.91**	

Item (8-It is easy to use interface that enables learners and instructors navigate easily through the different modules) has the highest mean (4.26), and S.D(0.909), this Indicates that Platform has an easy to use interface that enables learners and instructors navigate easily through the different modules. The following item is (2- Proposed platform provides flexible performance and ability to be accessed through various devices).

with mean value (4.18) and S.D (0.868) that means to the ability to open the platform from students' smart-phones to follow all the courses frequently and this also reduce costs related to provide computers for study and follow courses on the platform on line. The item (7- Lack of internet could be a challenge for students.) is the 3th, this indicates that this issue is one of the basic challenges associated to follow the courses frequently by students as well as difficulties that teachers are facing and this leading to delay lessons sometimes. The item (3- The proposed platform proved that it is simple to use and interactive, therefore, no need to have special computer skills) is also

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achieved high value of mean (3.97) and S.D (0.92) despite it is at the 4th grade, this indicates that the proposed system considerate that some users do not have enough skills to deal with complicate platform. Item (4- There is communication between students and their teachers) has also a high value (mean 3.91) and S.D(0.93) this is due to the feature of communication that it continues for 24 hours daily and this ensure the communication between student and his teacher at any desired time. Item (5- Students will be committed to attending and following the lessons on the platform) was in the 6th grade with (3.87 mean) and (0.819 S.D), despite that Platform follows up attendance of Students, then they do not abide for several reasons and the major reason could be the internet weakness. From item (6- Platform improves obviously the students' performance) which was at 7th grade with (3.79 mean) and (0.847) S.D. Despite all the features and censorship that are provided by the proposed system, the performance of student improvement still faces some challenges that could be associated to the surround environment. At the last grade (1- features of the proposed platform enhance the performance students) with (3.69 mean) and (0.91 S.D), this indicates that the improvement in the software of platform impact on the performance of students. However, there are other factors could challenge to apply this system effectively.

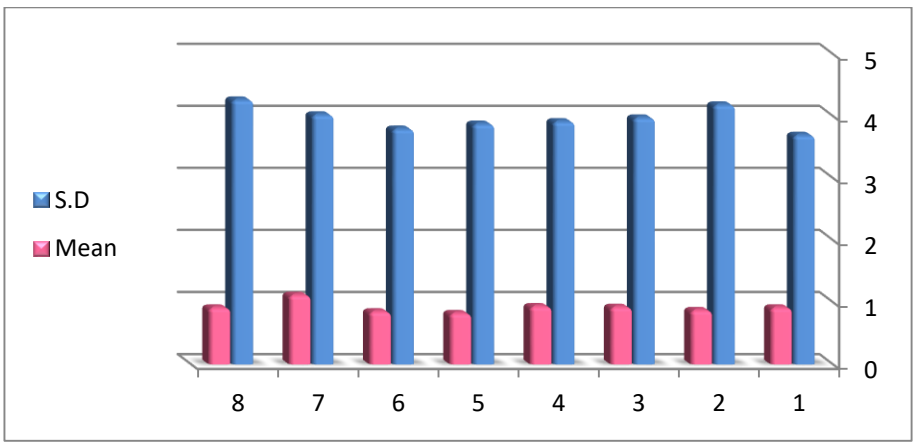

Fig (6): Statistical results of the impact of the proposed platform on teacher performance and its handling of content

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Table (2): Statistical results of the impact of the proposed platform on teachers

No.	Items	Mean	S.D.	Grade
1	instructors complete covering the curriculum	3.80	0.913	6
2	Teachers are facing difficulties in dealing with this platform	3.85	0.817	5
3	Teachers are committed to delivering lessons through the platform on a regular basis	3.69	0.99	8
4	Teachers work to improve the students' performance through this platform	3.78	0.95	7
5	teachers are working by participatory approach with each other	4.25	0.89	2
6	There is lack of expertise of employing online educational technologies	4.27	0.912	1
7	Preparing the educational materials and educational process management in the digital environment require considerable time	4.02	1.112	3
8	features of the proposed platform simplifies the work of teachers to provide better content for student	3.99	1.01	4
	Total	**3.956**	**0.96**	

Item (6-There is lack of expertise of employing online educational technologies) was the first grade with (4.27 mean) and (0.912 S.D), this indicates that it is necessary to make more efforts to increase the capability of teachers to deal with novel platforms that designed based on software Principles. The following item was (5- teachers are working by participatory approach with each other) with (4.25 mean) and (0.89 S.D), this is due to the properties that are provided by the proposed system that enables teachers to assign several tasks and learn by participatory approaches

Item (7-Preparing the educational materials and educational process management in the digital environment require considerable time) that was at 3rd grade with (4.02 mean) and (1.112 S.D) presents the difficulties that teacher could face when they dealing with electronic materials. Item (8- features of the proposed platform simplifies the work of teachers to provide better content for student) was at 4th grade with (3.99 mean) and (1.01 S.D), this indicates that, if teachers have a simple skills associated to use technologies, they are using this platform easily due to the features provided by platform. The following Item (2-Teachers are facing difficulties in dealing

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with this platform was at 5th grade with (3.85 mean) and (0.817 S.D), this indicates that despite the simple design some teacher could be enable to deal with platform based on software. At the 6th grade, item (6-instructors complete covering the curriculum) with (3.80 mean) & (0.913 S.D), this means that despite that platform provide an accurate supervision, teachers still face challenges to be committed frequently. Item (4-Teachers work to improve the students' performance through this platform) was at 7th grade, with (3.78 mean) and (0.95 S.D), it means that not only advanced design is required to improve students' performance through e-Learning. however, other factors should be determined to integrate with advancements in platform designing process, item (Teachers are committed to delivering lessons through the platform on a regular basis) was at the last grade with (3.69 mean) and (0.99 S.D), this indicates that it is necessary to support the e-learning environment in addition to improve new designs of e-learning platforms.

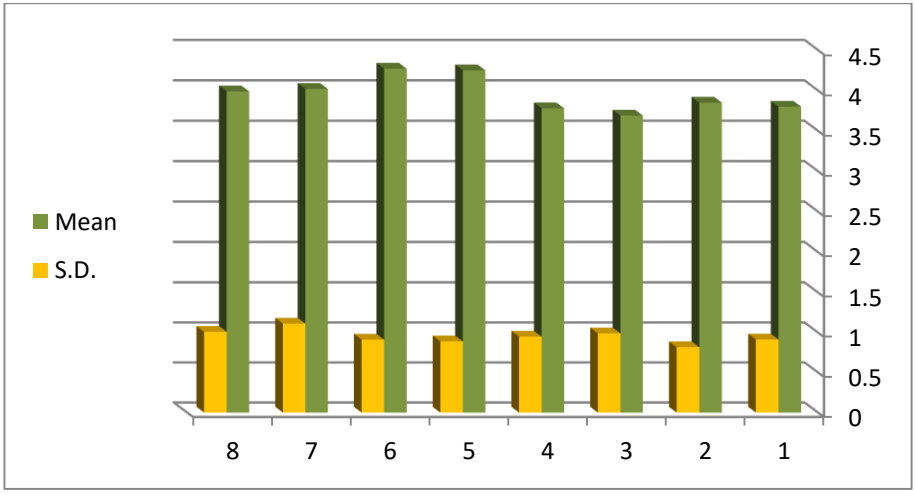

Fig (7): Statistical results of the impact of the proposed platform on teachers

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Conclusion

In this search, the effect of Software Engineering Principles application on Web Development Process is investigated. This is implemented by designing an e-Learning platform based on Incremental-model, this system is implemented using HTML, CSS, PHP and JavaScript. To design database, MYSQL is employed, and based on Visual basic tool. This system provides simple interface for using for both teachers and students, it also provides a unique property such as:

1. Teachers are working by participatory approach with each other
2. Accurate supervise by platform on instructors for complete covering the curriculum.
3. The proposed system proved that it is simple to use and interactive, then, special computer skills are not necessary.
4. Simplify to use interface that enables learners and instructors navigate easily through the different modules.
5. Learners could be taking questions of quiz at any time they would be ready as well as other features that ensure improving the students' performance such as the ability to view their class, notifications viewing, view the education materials and download them.

The second part of study was to implement an analysis to the data that are gathered through questionnaire, the data is processed by SPSS. Results had presented that platform which provides flexible performance and has ability to be accessed through various devices, enables teachers to assign several tasks and learn by participatory approaches and has extra properties, there are some challenges that impact on application this platform affectively to improve the performance of students such as lack of internet and lack of expertise of employing online educational technologies, in addition to the time that is required to prepare and design electronic materials.

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