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Evaluation of Infrastructure for E-Learning System in AOU-Bahrain Branch

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ABSTRACT

E-learning web sites have become a mission critical component of the Arab Open University (AOU) as more and more distance learning have come to rely on it. This paper presents a guide line to measure and to evaluate the performance of e-learning system that has supported a real-time communication in campus environment. The overall e-learning system performance is measured by Network performance, applications server performance, database server performance and websites tools performance based on the number of accesses by students and faculties. This research work creates a series of tables as index of infrastructure healthiness. Apart from that two on-line analysis questionnaires, oriented to staff and students, have been conducted online to measure and evaluate the overall e-learning system performance, based on the outcomes of conducted questionnaires the overall performance of e-learning system have been measured.

Keywords: *Performance evaluation, e-learning system infrastructure, information system evaluation.*

1. METHODOLOGY

We have developed a systematic methodology that uses a series of data tables to drive and support the analysis. These Tables are used to clearly identify and document the monitoring and management components, processes, and tools that are the focus of the various system activities of e learning web-sites. One of the web sites is http://www.arabcampus.org, which we will abbreviate as ACES (Arab Campus E-learning System). It represents the blended-learning web site of Arab Open University in Bahrain. The faculty web site is http://www.fis.org.bh , we will abbreviate it by (FIS) and the students website http://www.sis.org.bh we will abbreviate it by (SIS). Two on-line analysis questionnaires oriented to staff and students were implemented to measure the infrastructure performance of (ACES, FIS & SIS), system utilization of tools, available resources, and the overall performance evaluation. This survey is part of research conducted in AOU-Bahrain Branch to improve services & performance of Blended-Learning system, where the infrastructure deals with a comprehensive management of a collection of applications. We suggested a plan to manage the actual online site operation. We proposed a performance management policy; some important issues have been answered and evaluated. We have an e-learning system that is able to support all the functions based on the requirement of AOU Bahrain branch. Figure 1 indicates the suggested development plan of e-learning system that has supported synchronous and asynchronous system. Figure 2 shows the actual infrastructure of the e-learning system indicating applications and data base servers used in AOU Bahrain branch.
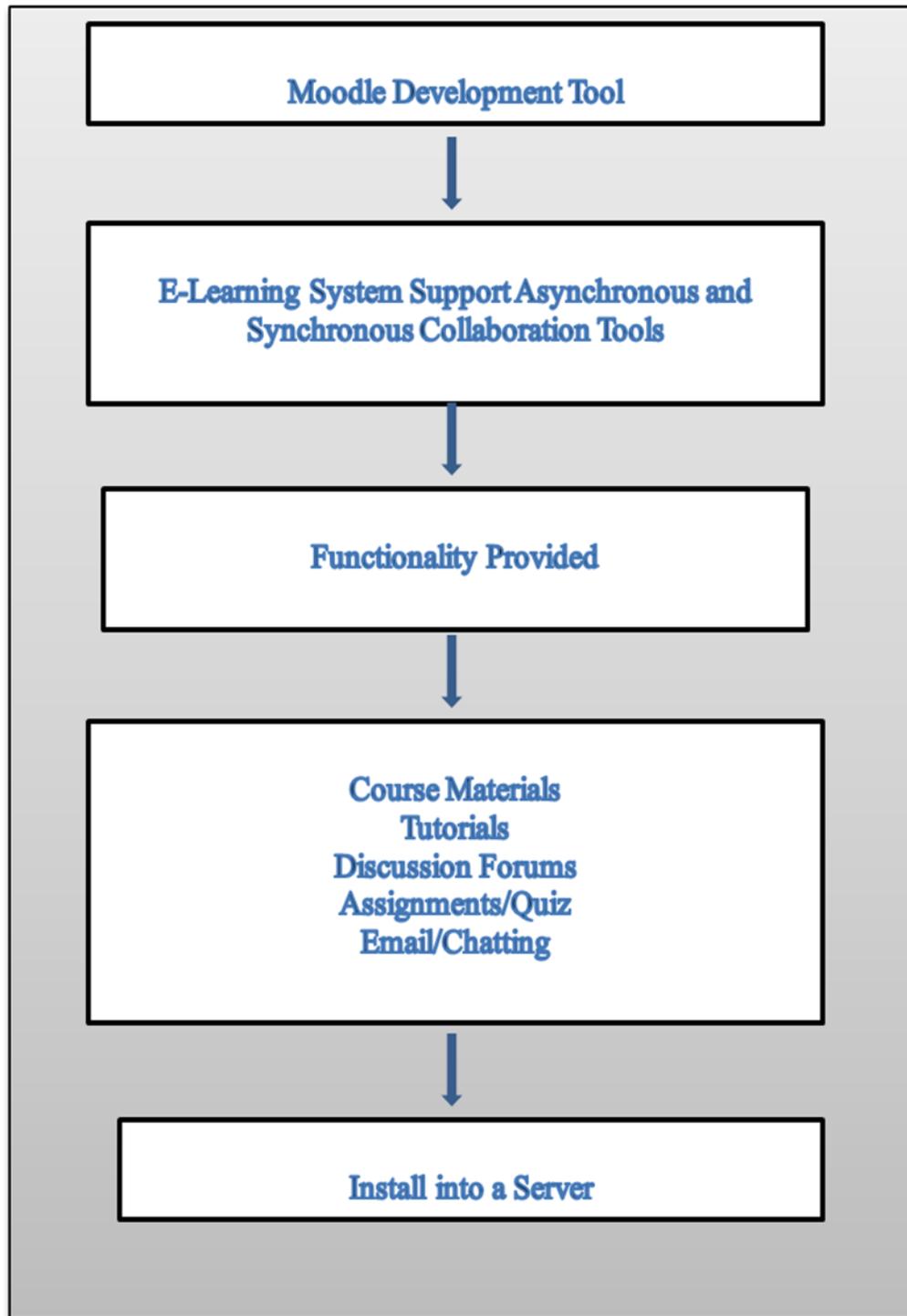
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Figure 1: Development of e-learning System
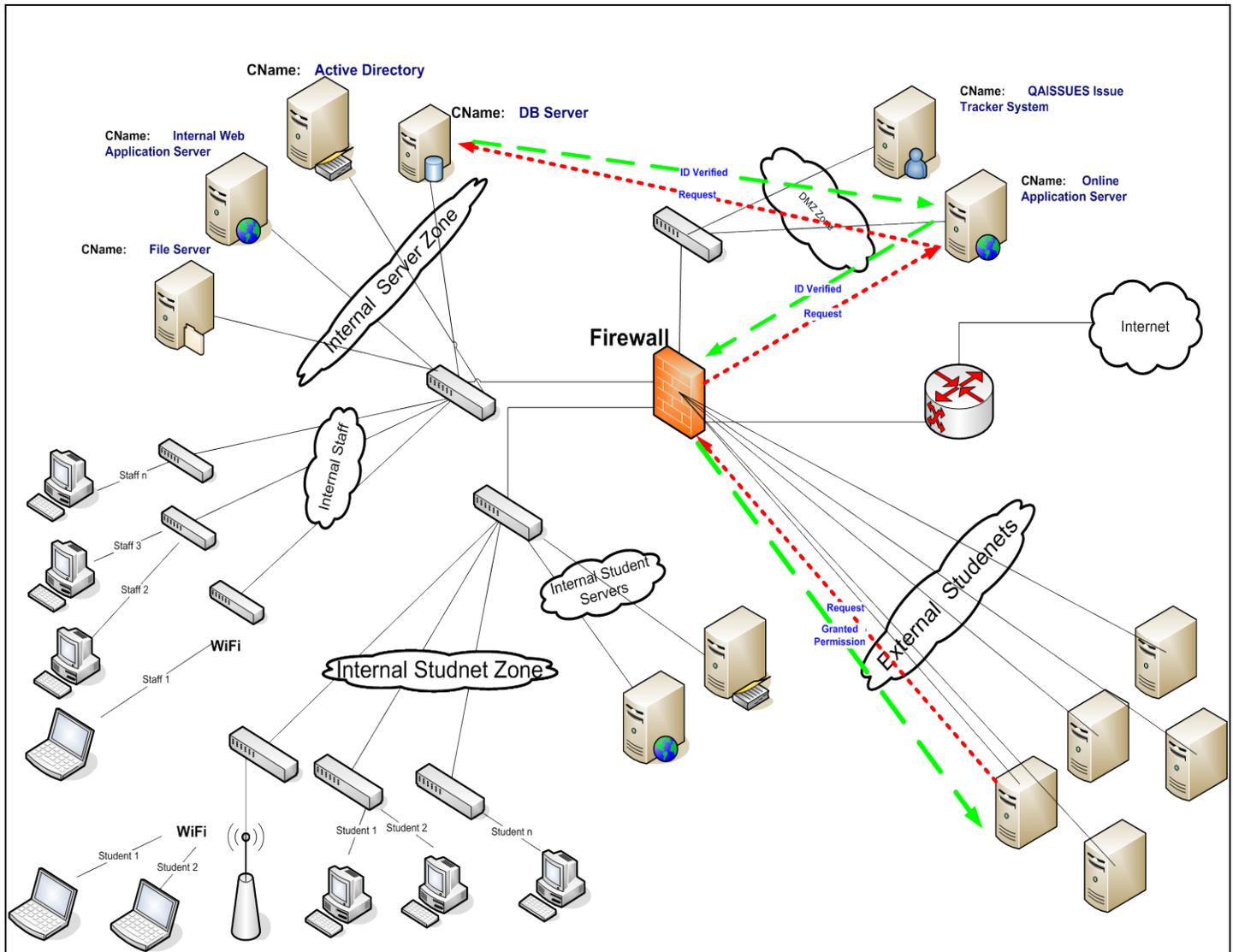
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Figure 2: Infrastructure of E-Learning system in AOU

2. INFRASTRUCTURE ISSUE

Concerning site's infrastructure we create Table 1 with as many specific components to be the index to the health of the infrastructure [1]. A good starting point should include the operating system, server hardware, network hardware, and other devices like fire wall and load-balancing servers; we derived the list of infrastructure components from the documentation for the web site[2]. For each specific component, a set of detailed components should be identified. For the operating system, this should include detailed components like CPU utilization, file systems, paging space, memory utilization, etc. These detailed components will become the focus of the monitors that will be used for ensuring the availability of the infrastructure [3],[4]. **Table 1** contains the index examples of infrastructure specific components and component details.

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Table-1: Study of E- Learning System in AOU oriented to 3 research directions: infrastructure, applications, and business functions.

. **Four components Infrastructure identification issues**

Specific Component	Component Details Monitoring to ensure availability
1.Operating System	CPU utilization, File systems, Paging space, Memory utilization
	OS processes monitoring (Virus alert, log service, etc.)
	Interface status, Network utilization, Packet loss, Network collisions, Network processes monitoring, External access.
2. Server	RAID array disk failure, CPU failure, Disk drive failure
3.Network Hardware	Switch and hub status, Router status
4.Other Devices	Load balancing device status, Firewall status, Caching server status

Application identification issues

Specific Component	Component Details
Application	Application processes (service) monitoring
Database	Database processes (service) monitoring
	Communication support monitoring
	Backup success monitoring
Middle-ware	Middle-ware processes (service) monitoring
	Queue monitoring, Channel monitoring

Business & Management identification issues

Specific Component	Component Details
Business system view(s)	A view or views that contains related applications and components
Business system monitor(s)	Checks all application interfaces, checks availability of queues between applications, and run a test transaction .
Business system command(s)	Shutdown, Startup, Restart, Display all (or selected) (services) of a business system

3. THE APPLICATIONS ISSUE

Web-Sites applications of the (ACES, FIS & SIS) contain e-registration, e-payment, online courses, and TMA submission, uploading lectures, grades, web-mail, e-library, forum and WEBEX chatting with students [5]. The middle part of Table **1** focuses on the database, middle-ware, and the application itself contains index examples of application specific components and component details [6].

4. The Business & Management Issue

For the business aspect of the system perspective, the focus is on relating the applications as business systems. To relate applications as business systems, components are

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grouped and taken as a whole. Views are used to visually manage the business systems. Business system monitoring is more inclusive than regular monitors are. For example, a business system monitor could have a monitor called 'all business system interfaces'. The lower part of **Table 1** contains index examples of business specific components and component details. Voting system and suggested feedback form to be added to web sites to measure level of staff and student satisfaction in order to improve system performance and quality of services. Management is a process whose goal is to provide defect-free implementation of changes to the system environment [7]. This process includes planning and documentation of the change, real time management of the change, verification of completion or, in the case of failure, verification of restoration back to the original state, and follow-up analysis and reporting. From a system-monitoring viewpoint, we see the following three important issues:

- How to reactivate the monitoring system follows a change activity to verify that all systems and services are functioning normally.
- How to convert problem management activities into change activities
- How prepared to change tools, and processes are to handle the Web site better.

Problem management is the successful awareness of and response to all monitoring tool alerts and other manually reported or detected problems and the resolution of any events, conditions, failures, etc indicated by this information. The entire set of activities is focused on ensuring that the site is available and functioning in the manner in which it was designed. The 7x24 nature of e-learning web sites and the number of systems used in the typical web site indicate that in order to scale the problem management system and control costs some degree of automation is required. Automation can insure a rapid response to simple problems regardless of when they occur. Performance management is focused on the measurement and reporting of system resources by the application and its users. Performance management can be used to report problems in real time but is generally used to determine performance trends and to plan for necessary resources upgrades or modifications [8]. **Table -2** is based on actual feedback from students (SIS & ACES) using online voting system (for courses M150B, MT262, and M359). With blended-learning Strengths, will help them to learn better, improve their technology skills and help them to communicate better so (29.9%) of respondents always agree, while (39.34%) of respondents frequently agree that using blended-learning was also linked to find new room for improvement and good opportunities. The overall (69.33%) of respondents stated positively about (SIS & ACES) performance. The outcomes shown in Figure-3 will measure performance of e-learning system by being able to trace the students' preferences, and to find a new opportunities to enhance the learning environment in AOU, which will associate or affiliate more people in the community to join blended learning in AOU, conversion rate (switching from traditional learning to blended-Learning).this will Increase Revenue & Decrease Expenses (cost).

Table-2: Questionnaire with the Results used among Students in the Study of (SIS & ACES) Infrastructure for E-Learning System in AOU-Bahrain Branch

Question	Always	Frequently	Occasionally	Rarely
1. Do you think that the AOU wireless internet is sufficient and unproblematic to work with ACES system?	35.39	35.20	21.75	19.46
2. Did you receive a good level of service during the registration process through SIS (Students Information System)?	30.67	40.57	15.01	13.75
3. Are you fully satisfied with the support received during the first weeks of lectures every semester through ACES?	26.47	42.31	17.35	13.86
4. Do the ACES allow easy access to information?	35.86	38.28	16.97	8.89
5. Do you think the GUI (graphical user interface)/configuration color/ background are clear and uniform format in the ACES?	35.53	36.90	15.16	12.41
6. Do you experience any problem(s) while navigating between course pages in ACES?	17.44	30.56	22.72	29.29
7. Are you satisfied with the browsing and downloading speed of lecture materials using ACES?	30.11	43.12	17.17	9.60

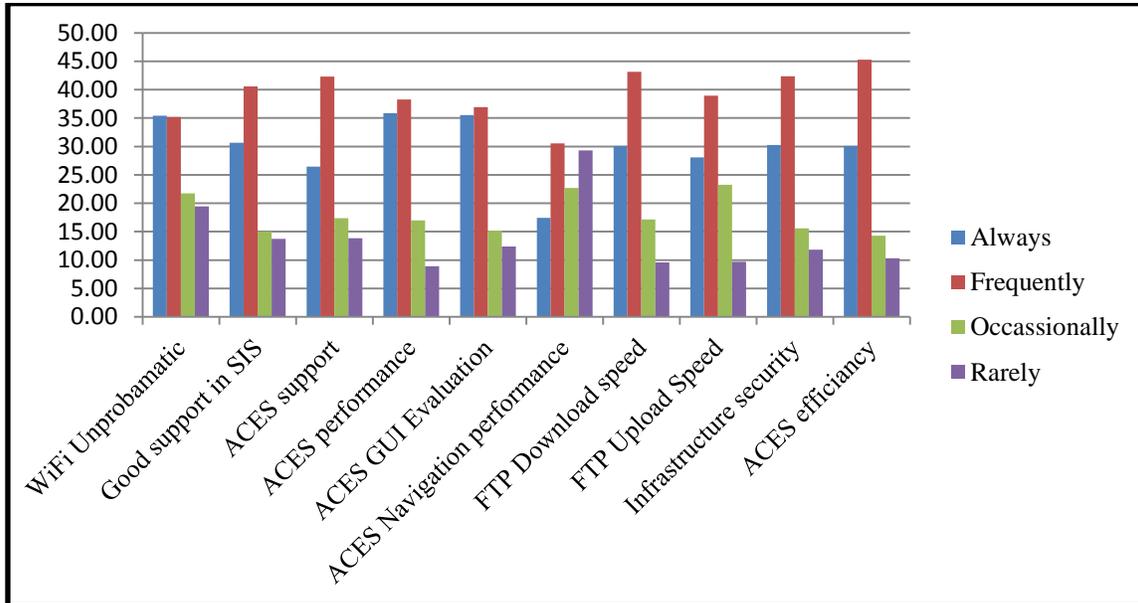|				
8. Are you satisfied with the server speed while uploading TMAs?	28.07	38.94	23.28	9.71
9.Do you believe that the IT infrastructure of ACES is reliable and secure?	30.23	42.35	15.61	11.82
10. Do you believe the ACES communication tools are efficient and fast?	30.08	45.28	14.31	10.34

Figure 3: Outcomes of infrastructure study for e-learning system in AOU-Bahrain Branch

Table-3: Questionnaire with the Results used among Faculties in the Study of (FIS & ACES) Infrastructure for E-Learning System In AOU-Bahrain Branch

Questions	Strongly Agree	Partially Agree	Neither Agree Nor Disagree	Partially Disagree	Strongly Disagree
1. The AOU wireless internet is sufficient and unproblematic to work with ACES and FIS.	6	4	1	1	0
2. FIS help me get the required information for my courses.	5	2	2	2	1
3. FIS help me in arranging examination invigilation schedule efficiently.	7	3	1	1	0
4. The ACES allow easy access to information.	8	2	1	1	0
5. The GUI (graphical user interface)/configuration color/ background are clear and uniform format in the ACES.	7	4	1	0	0
6. I do not experience any problem while navigating between course pages in ACES.	5	5	2	0	0
7. The server speed is enough for browsing, uploading lecture materials and TMAs using	4	4	3	1	0

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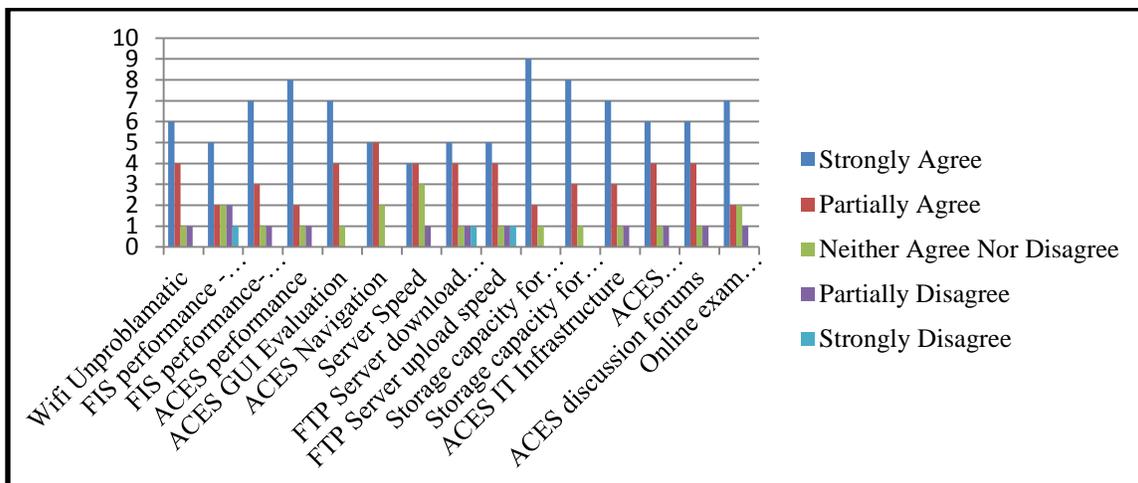| ACES.					
8. The server speed is sufficient while downloading student submitted TMAs.	5	4	1	1	1
9. The server speed is sufficient while grading and sending feedback to the student submitted assignments	5	4	1	1	1
10. The storage capacity (max 40MB) for the student assignment is sufficient.	9	2	1	0	0
11. The storage capacity (in MB) for an average course on the server is sufficient.	8	3	1	0	0
12. The IT infrastructure of ACES is reliable and secure.	7	3	1	1	0
13. The ACES communication tools are efficient and fast.	6	4	1	1	0
14. Discussions forums are used to provide fast feedbacks to queries.	6	4	1	1	0
15. I don't experience any problem(s) while conducting on-line exams through ACES	7	2	2	1	0

Figure 4: Outcomes of infrastructure study for e-learning system in AOU-Bahrain Branch

Surveys were disseminated via on line ACES to (12) full time tutors in AOU given in **Table 3**, (63.85%) of respondents strongly agreed with (FIS & ACES) performance. Figure-4 will measure the performance of e-learning system regarding faculty's satisfaction taken into accounts all components given in **Table1.**

5. CONCLUSIONS

This paper described a framework and supporting method to evaluate performance management tools and methods for online service of e-learning web site. Two perspectives are the basis of the framework system and support. Methodology is used for proactive planning which involves three steps: preplanning, analysis, and review. **Table 1** is used

to support the analysis associated with the methodology. The developed systematic methodology uses a series of Tables to drive and support the analysis. These Tables are used to clearly identify the monitoring and management components and focus on the used tools of the system activities, so system perspective has a focus on hardware and software grouped by infrastructure, application, and business components. The support perspective is centered on four processes, problem, performance, and security. The analysis has been conducted in **Table 2** to measure system effectiveness of (SIS & ACES) regarding students satisfaction which is good (69.33%). **Table 3** is based on faculty perspectives that incorporate tools, processes, organizational structure, and staff skills to evaluate system performance regarding (FIS & ACES) which is (63.85%). The developed whole methodology focused on improvement of

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availability, performance, consistency, and reliability of E-learning system. It is expected that the overall outcomes of fulfillment the questionnaire point out that the implemented e-learning system in AOU has the following characteristics:

- The e-learning system is clear and concise
- The system has built in incentives to motivate compliance
- Compliance is verifiable and enforceable
- System has a good control for legitimate use: access, authentication, and authorization
- There is regular backup of all critical data
- There is a disaster recovery and business continuity plan

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