# Assessment of Quality of the Electronic Education System in the Corona Crisis Period: Applied Study on Al al-Bayt University

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**Abstract—**In response to the coronavirus crisis, higher education institutions have partially or fully transformed into electronic education systems (EESs). This paper presents the results of a student survey conducted at AL al-Bayt University to assess the quality of the electronic educational system (EES) during the coronavirus pandemic. The study variables addressed by the questionnaire were tangible physical features (TPFs), flexibility (FEES), examination construction and management (ECM); admission, storage, and registration management (ASRM), security and privacy (S&P), learning site content (LSC); and students' level of satisfaction (LoS). The exploratory study methodology was applied to 324 students at AABU, where the research data were collected using a Google Docs questionnaire and distributed to students. The results highlighted that students were satisfied with the quality of EES implemented by AABU during the lockdown period in terms of tangible physical features (TPF) and learning site content (LSC) and there was a statistically significant relationship between TPF and LSC. However, some undesirable features were reported, such as a lack of adequate infrastructure for students, which enabled them to interact effectively with their teachers to gain the target of applying EES. Consequently, AABU needs to implement effective measures to improve and increase the quality and level of satisfaction with EES. Finally, electronic education is a more adapted, smooth, and affordable alternative than traditional face-to-face education.

**Keywords—**electronic education, service quality, satisfaction, learning site content, tangible physical features

## 1 Introduction

The world witnessed the spread of the coronavirus in December 2019. In 2020, the World Health Organization (WHO) announced the spread of the virus and considered it a pandemic. The education sector, without exception, witnessed closures that affected

more than 190 countries, including approximately 94% of school and university students worldwide. It was estimated that this percentage can reach 99% of the student community in low-income countries such as Africa.

As a result of the closures associated with the Corona crisis, many educational institutions resorted to using a flexible system that relied on modern technology to ensure the continuity of the educational process. Therefore, electronic education (e-education) has become an integral part of the educational process and has been used in the educational domain with the goal of providing a multi-source, interactive, and vital educational environment to benefit from these technologies and keep pace with rapid developments. Hence, the concepts of e-education, open education, and partial or complete distance education have come to light. E-education is a formal system that uses electronic resources [1]. Teaching can be conducted either inside or outside the university campuses. The use of information technology and the Internet will facilitate the adaptation of the educational process to new circumstances, such as coronavirus crisis instead of using the traditional educational system [1]. For example, university teachers rely on mixed teaching methods to meet students' needs using hybrid teaching methods that combine synchronous and asynchronous teaching [2]. This hybrid method ensures effective communication between students and their teachers through homework, assignments, and examinations. Thus, there is a need for an appropriate platform for electronic education systems (EES) [3].

Compared to developed countries, developing countries face many challenges in implementing electronic learning, including poor Internet connectivity and weak content of learning sites. Content development [4]. The success of e-education depends on the development of a suitable EES and its selectivity in terms of meeting educational requirements and its continuous updating to keep up with developments. In addition to considering the standards of education systems, especially in light of the distance between the teacher and the learner.

In higher education institutions, service quality is key to determining the performance of educational systems.

The SERVQUAL model is a service quality model designed by Parasuraman et al. in 1985 [5] and has been used in several studies to assess the quality of educational systems [6, 7]. This model is based on students' expectations and perceptions of the services provided, and evaluates the quality of services through five dimensions [6, 7]:

Tangible physical features (TPFs) and facilities are related to the environment of the educational service providers.

Assurance, where the student is seen as trustee and hence the educational service is properly performed for the first time.

Responsiveness refers to the speed of a student's response and replying to her/his inquiries quickly and at the relevant time.

Security. This includes the absence of danger, risk, or suspicion regarding dealing.

Empathy expresses concern for the feelings of students and preservation of their privacies.

This study focused on analyzing the demographic characteristics of gender, age, region, study track, faculty type, online education, and number of online courses. Gauge

students' perceived and expected service quality using the SERVQUAL Model. In addition, assessing the overall satisfaction of students toward educational services and determining which service quality dimensions best correlate with students' overall satisfaction.

## 2 Related work

In the past few years, multiple studies have been conducted to assess the quality of educational services and the factors that impact student satisfaction with the educational system during the coronavirus pandemic. Electronic education has become an increasingly popular alternative to conventional teaching and learning. For instance, Roushdy and El-Ansary [8] applied the SEVRQUAL model to analyze students' perceptions of e-education quality in two Egyptian universities. The findings reveal the importance of e-education quality in ensuring student satisfaction. Consequently, it is necessary to continuously improve educational content to enhance the interactions between students and teachers. Similarly, the SERVQUAL model was used in [7] to study the association between service quality and student satisfaction. The results revealed that the quality of service had a positive impact on satisfaction, consistent with previous results [9]. Almigheerbi et.al. [10] applied the SERVQUAL model to evaluate an education system at Tripoli University.

Jameel et.al. [11] conducted a comprehensive study in Iraq to evaluate the influence of e-education on student satisfaction. This study spanned three private universities in Erbil City and used questionnaires to evaluate educational quality and student satisfaction. The outcomes highlighted that responsiveness, privacy, and security had a positive impact on students' satisfaction with e-education. Moreover, timely responses to student requirements were identified as the most critical factor in achieving student satisfaction. Thus, the study suggested that the university administration seriously considered this variable, in addition to security and privacy factors. In 2021, Leonnard [12] conducted a study investigated the association between e-education platforms, EES quality, and student satisfaction. Data were collected using a questionnaire that was distributed to 286 university students. The Chi-square test results revealed no statistically significant relationship between the quality of the technical system, e-education, and student satisfaction. This illustrates that the basic system options did not affect the students' perceptions of quality and satisfaction. Thus, the quality of e-education must be improved to meet the needs of novel learning during the coronavirus crisis and for students to be content with their participation in the educational process.

In the same context, Saxena, Baber, and Kumar in 2020 [13] conducted a study in one of the universities in India to examine the variables that affect the quality of remote e-education and students' satisfaction with this mode of education. This study was conducted with 435 students, using a structural model. It was found that reliability, responsiveness, and content published on websites were factors affecting the quality of e-education during the pandemic, which, in turn, affected student satisfaction. This was confirmed by Ohliati and Abbas [14] in their study in 2019, which aimed to determine the factors influencing student satisfaction with the management of e-education. The

study was conducted with 100 students at a private university to examine the quality of information, quality of the system, quality of the educational services, extent to which the students benefitted from the information received, and quality of communication. The results revealed that quality of information, quality of services, and quality of information reception were the factors that most influenced student satisfaction with the quality of e-education.

To determine the factors that affect the quality of e-education, Abaad et al. [15] focused on five dimensions of e-education services quality: assurance, reliability, sympathy, responsiveness, and tangibility. Exploratory and regression analyses were conducted to examine the model's reliability and validity. The study was conducted with 421 students. The results revealed that educational content plays a statistically significant role in students' perception of the quality of e-education, which in turn affects their satisfaction with the quality of e-education.

In 2020, Zahia [16] conducted a study to confirm the role of e-education in the success of high education institutions (HEIs) as the university on which the study was performed could adopt the e-education system within 24 h from the beginning of the total closure of HEIs and could overcome all the obstacles faced by faculty members and students by means of training, which facilitated commencing virtual education without stopping the progress of the educational process. This enabled more than 95 million educational minutes to be recorded and more than 49,000 virtual classes to be created, confirming the effective role of e-education in the success of HEIs.

In addition, Papadakis et al. [18] examined the attitudes of in-service and pre-service early childhood teachers toward Educational Robotics (ER). To obtain data, the researchers used a questionnaire (N = 201) and employed latent class analysis (LCA). The results revealed that both teaching experience and age had a negative impact on attitudes toward ER implementation, whereas knowledge of ER had a positive effect. Furthermore, there was no difference in attitudes towards the use of ER between service and pre-service teachers. These findings suggest that ER should be considered when designing early childhood education curricula to add value to the educational process. In addition, a team of researchers [19] studied the mathematics practices of preschool teachers during remote teaching, and how digital tools are used for mathematics instruction after classroom reopening. Semi-structured interviews were conducted with 16 Greek kindergarten teachers, and the responses were analyzed using thematic analysis. The results indicated that mathematical activities, such as numbers, operations, geometry, and measurement, are conducted in digital preschool classrooms during distance learning. Implications for the professional development of preschool teachers are discussed. Another study was conducted with 25 Turkish preschool teachers to gain further insight into such activities. This study illuminates the issues and conditions of remote teaching in early childhood mathematics. Although remote education cannot fully replace traditional education, it can still have a significant impact on the teaching and proper training of targeted and well-prepared teachers. It is suggested that the experiences of parents and teachers are triangular, considering the role of parents in the catalytic role of remote education.

The quality of the educational system and student satisfaction should be evaluated and assessed regularly to ensure that high-quality educational services are provided

along with an adequate platform. This study was conducted to address the variables that influence the quality of services and student satisfaction during the coronavirus pandemic. Additionally, it aims to analyze the quality assessment of the EES offered by ABBU and evaluate student satisfaction, which has not been previously applied in AABU. This research intended to be a starting point for assessing the quality of EES to be implemented at the beginning of the academic year, and to conduct further studies related to the improvement of EES in AABU.

# 3 Method

Owing to the epidemiological situation, this study was conducted with students of AABU, a public university located in the northern region of Jordan. The researcher used the Internet to conduct this study to facilitate quick communication with the students. Data were collected in a fast and effective way and analyzed at the lowest cost and with no errors compared to traditional data collection methods, such as paper questionnaires, phone interviews, personal interviews, and paper (traditional) mail. Furthermore, this method of data collection secures the privacy of all parties involved in the study and does not affect them during data collection, in addition to preserving the health of students.

## 3.1 Method design

The necessary data were collected using a quantitative approach, which required students to respond to closed questions. Data collection was conducted in the period extending from May 20 to June 5, 2022, by distributing questionnaire forms to potential university students. The questionnaire design was guided by standards for the quality of EESs. It was then distributed to the students as a 'Google Form' through educational platforms, social media, and electronic mails (e-mails). In total, 500 questionnaires were distributed. Of these, 323 were retrieved. The questionnaire was divided into two parts. Part A included basic information about the students, such as age, gender, region, and number of online courses. Part B comprised several questions that evaluated and assessed service quality and student satisfaction. A five-level ordinal rating scale was used, ranging from one ("strongly disagree") to 5 ("strongly agree").

System quality was probed using measures of the tangible physical features (TPFs) of the EES, flexibility of the EES (FEES), examination construction and management (ECM), admission, storage, and registration management (ASRM), security and privacy (S&P), and learning site content (LSC) according to the SERVQUAL model to judge the level of quality of the educational service by identifying the extent of congruence between students' expectations of services and their actual performance. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 24.0.

It should be noted that the standards of EES quality are defined as the minimum specifications required to develop an electronic educational system. This minimum bound is the minimum number of specifications that must be available in an electronic system to achieve desired goals. These standards are defined as a set of procedures that

declare the foundations on which the EES is based. The aim is to ensure that the final educational product meets or exceeds the technological requirements. Standards are items or phrases that describe or control the process of designing and producing an electronic education curriculum in a way that guarantees its quality. The quality of e-education is attributed to setting quality and excellence specifications for both educational institutions and individuals, besides being considered as a reference for faculty members, educational leaders, and educational decision makers and executives, so as to upgrade the educational level, especially during the Corona period and the associated closures that people all over the world were forced to go through. These criteria were used to achieve the goal of this study, which was the evaluation of quality of the EES. These standards are:

1. Tangible physical features (TPFs) of the EES,
2. Flexibility of the EES (FEES),
3. Examination construction and management (ECM),
4. Admission, storage, and registration management (ASRM),
5. Security and privacy (S&P), and
6. Learning site content (LSC).

### 3.2 Research method

A total of 323 students who attended classes during the coronavirus crisis at AABU participated in this study. This sample comprised more than 2% of all the students in the AABU. The target students were scientific and literary faculties. The students willingly and anonymously participated in this study.

This study collected fundamental information about the sample students (Table 1) and subjected them to frequency distribution analysis (FDA) so as to define the sample. In terms of gender, it is seen (Table 1) that the sample included more male students (177, 54.8%) than female students (146, 45.2%). The majority of the sample students (265; 81.8%) belonged to the youngest age group (18-20 Years), followed by students ranging in age from 21 to 23 years (45; 13.9%). A much lower number of the sample students were older than 23 years (14; 4.3%). Regarding the region of residence, this study found that 164 (48.1%) of the sample students lived in the northern region of the country, mainly because the university itself is located in Al Mafraq, a northern governorate. A small number of sample students lived in the central region of the country (155; 48.1%). Only three students (0.90%) lived in the southern region.

Furthermore, it was found (Table 1) that most of the sample students (237, 73.1%) followed the scientific track of study in high school. Fifty-seven students (17.6%) followed the literary track of studying in a high school. The remaining sample students (30; 9.3%) followed other tracks (e.g., vocational tracks). To some extent, these percentages were reflected in the nature of the university faculty where the students were studying. For example, Table 1 shows that the vast majority of sample members (303; 94.4%) were scientific faculty students. However, only a few students were in literary faculty (18, 5.6%).

**Table 1.** Basic information about the student

| | | | | Percentage |
|---|---|---|---|---|
| **Characteristic** | **Groups** | **Frequency** | **Valid** | **Cumulative** |
| Gender | Male | 177 | 54.8 | 54.8 |
| | Female | 146 | 45.2 | 100.0 |
| | Total | 323 | 100.0 | |
| | Missing | 2 | | |
| Age group | 18-20 Years | 265 | 81.8 | 81.8 |
| | 21-23 Years | 45 | 13.9 | 95.7 |
| | > 23 Years | 14 | 4.3 | 100.0 |
| | Total | 324 | 100.0 | |
| | Missing | 1 | 50.9 | 50.9 |
| Region of residence | North region | 164 | 50.9 | 50.9 |
| | Middle region | 155 | 48.1 | 99.1 |
| | South region | 3 | .9 | 100.0 |
| | Total | 322 | 100.0 | |
| | Missing | 3 | | |
| Study track in school | Scientific track | 237 | 73.1 | 73.1 |
| | Literary track | 57 | 17.6 | 90.7 |
| | Other | 30 | 9.3 | 100.0 |
| | Total | 324 | 100.0 | |
| | Missing | 1 | | |
| Nature of faculty of study | Scientific Faculty | 303 | 94.4 | 94.4 |
| | Literary Faculty | 18 | 5.6 | 100.0 |
| | Total | 321 | 100.0 | |
| | Missing | 4 | | |
| Online education before | No | 41 | 12.7 | 12.7 |
| | Yes | 283 | 87.3 | 100.0 |
| | Total | 324 | 100.0 | |
| | Missing | 1 | | |
| Number of online courses | 1-5 Courses | 220 | 69.2 | 69.2 |
| | 6-10 Courses | 42 | 13.2 | 82.4 |
| | > 10 Courses | 56 | 17.6 | 100.0 |
| | Total | 318 | 100.0 | |
| | Missing | 7 | | |

A notable finding is that a large number of the sample students (283; 87.3%) joined online courses before the Corona crisis period. Only 41 students (12.7%) had no such experience. However, almost 70.0% of the sample members (220; 69.1%) joined to 1-5 online courses before the Corona crisis time. Forty-two students (13.2%) joined to 6-10 online courses, and only 56 students (17.6%) joined more than ten online courses

(Table 1). Hence, almost all the sample students (318) had an online education experience before the Corona crisis times. Considering that the overall number of participating university students was 325, Figure (318) represents 97.8% of the sample.

In sum, most of the sample members were male students aged 18-20 years who followed the scientific stream in high school and were dwelling in the northern region of the country. Most of the sample students joined the scientific stream in high school and were then registered with a scientific university faculty member. They experienced online education and enrolled in at least to 1-5 online courses before the Corona crisis period.

## 4. Research results

The main research hypothesis is the following:

HR: There was a statistically significant ($\alpha = 0.05$) relationship between student satisfaction with electronic education and service quality.

Student satisfaction was assessed using three measures: satisfaction with the electronic education system (SEES), satisfaction with the educational content employed (SEEC), and satisfaction with the content of the electronic website (SCEW). Therefore, with reference to the investigated aspects of student satisfaction, the main research hypotheses can be divided into three secondary ones.

HR1: There is a statistically significant ($\alpha = 0.05$) relationship between student satisfaction with the electronic education system and service quality.

HR2: There is a statistically significant ($\alpha = 0.05$) relationship between student satisfaction with the educational content and service quality.

HR3: There is a statistically significant ($\alpha = 0.05$) relationship between student satisfaction, content of the employed electronic website, and service quality.

After testing the three secondary research hypotheses, the main research hypothesis (HR) is tested.

Service quality (SQ) was defined in the present study in terms, SQ was defined in term of six dimensions: tangible physical features of the electronic education system (TPF), the flexibility of the electronic education system (FEES), construction and management of examinations (CME), acceptance, storage, and registration management (ASRM), security and privacy (SP), and learning site content (LSC). Therefore, each of the three secondary hypotheses was split into six tertiary hypotheses, one each addressing one of the SQ measures under study. For example, for TPFs, the first tertiary research hypothesis (HR11) is as follows.

HR11: There is a statistically significant ($\alpha = 0.05$) relationship between student satisfaction with the electronic education system and tangible physical features.

It should be noted that all statistical tests were performed at the 0.05 level of statistical significance ($\alpha$) in the environment of the Statistical Package for Social Sciences (v. 24.0). It should also be pointed out that while the foregoing research hypotheses are research hypotheses (HR), statistical software usually tests for the null hypothesis (H0) rather than the research (HR) hypotheses. In this study, all null hypotheses negated the presence of statistically significant associations between the investigated variables.

### 4.1 Frequency distribution analysis

Frequency Distribution Analysis was conducted to explore the viewpoints of the sample students on the quality of electronic education at AABU during the Corona crisis period. In this context, in the present study, the quality of service (SQ) was approached using six facets or dimensions. The outcomes of the analysis are presented in six separate subsections, one for each facet.

**Tangible physical features of the electronic education system.** The perspectives of the sample students on the tangible physical features (TPFs) of the electronic education system (EES) employed in the AABU were assessed using seven questionnaire items (Table 2). These items have been submitted to the FDA. The analysis results revealed the following.

The majority of the sample students (208; 64.2%) agreed that the EES website was easy to use by the students (Item 1, Table 2), as 147 students (45.4%) agreed with this and 61 other students (18.8%) agreed strongly with it. Forty-eight students (14.8%) disagreed and 68 were neutral in this regard.

More than half of the sample students (182; 56.4%) agreed that the design of the EES website was compatible with the provided scientific material (Item 2, Table 2), because 141 students (43.7%) agreed with this and 41 students (12.7%) agreed strongly with it. Sixty-five students (20.1%) disagreed and 76 were neutral.

The fact that the EES website is characterized by smoothness and clarity to attract the attention of students is a somewhat controversial issue. The results of the analysis (Table 2) show that less than half of the respondents agreed on this issue (153, 47.3%). However, only 99 respondents (20.7%) disagreed and 71 (22.0%) were neutral in their opinion.

The EES website provides students with the ability to download multimedia files such as photos and videos. The analysis revealed that nearly two-thirds (232 (sum of students who agree and those who strongly agree); 72.9%) of the sample students supported this issue. A total of 33 respondents (10.4% (sum of students who disagree and those who disagree strongly)) disagree with this, and 55 students (17.2%) were neutral in position (Table 2).

From the perspective of the sample students, it seems that the administration of the university does not work well enough to provide computer devices and internet packages for the students. The results (Table 2) show that only 94 students (29.3%) agreed that the university provided them with computer devices and Internet packages, whereas slightly more than half of the respondents (169; 52.7%) disagreed. Fifty-eight students (18.1%) assumed a neutral position on the issue.

The EES employed by AABU is compatible with various operating systems such as Windows, Linux, and Unix. Two hundred and six students (64.6%) agreed with this, and only 32 students (10.0%) disagreed. Meanwhile, approximately a quarter of the respondents (81, 25.4%) were neutral in their opinion on this issue (Table 2).

The electronic system employed by the AABU supports multiple databases. This study was supported by 153 students (47.6%). However, while 112 respondents (34.9%) were uncertain, only 56 (17.5%) disagreed (Table 2).

**Table 2.** Sample students' views on the tangible physical features of the electronic education system

| No. | Item | Level of Agreement | | | | |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | *5* |
| 1. | The website is characterized by ease of use for the students. | 17 (5.2) | 31 (9.6) | 68 (21.0) | 147 (45.4) | 61 (18.8) |
| 2. | Design of the website is compatible with the provided scientific material. | 20 (6.2) | 45 (13.9) | 76 (23.5) | 141 (43.7) | 41 (12.7) |
| 3. | The website is characterized by smoothness and clarity to attract attention of the students. | 31 (9.6) | 68 (21.1) | 71 (22.0) | 109 (33.7) | 44 (13.6) |
| 4. | The website provides the students with the ability to download multimedia files such as photos and videos. | 12 (3.8) | 21 (6.6) | 55 (17.2) | 155 (48.8) | 77 (24.1) |
| 5. | The university administration works on providing computer devices and Internet packages for the students. | 102 (31.8) | 67 (20.9) | 58 (18.1) | 60 (18.7) | 34 (10.6) |
| 6. | The electronic learning (e-learning) system allows the use of operating systems like Windows, Linux, and Unix. | 14 (4.4) | 18 (5.6) | 81 (25.4) | 154 (48.3) | 52 (16.3) |
| 7. | The employed electronic system supports multiple databases. | 22 (6.9) | 34 (10.6) | 112 (34.9) | 114 (35.5) | 39 (12.1) |

**Flexibility of the electronic education system.** Flexibility of the EES was the second dimension of the SQ examined in this study. The FDA outcomes are as follows:

Nearly two-thirds of the sample students (201; 63.6%) supported the idea that employing an electronic system allows many students to use it simultaneously. About one-fifth of the students (66, 20.8%) disagreed. The remaining students (n = 50, 15.8%) were undecided (Table 3).

A slightly higher proportion of the sample students agreed (127; 39.8%) than disagreed (112; 35.1%), as the electronic education system enabled students to change icons, colors, and interfaces and arrange content lists according to their desires. The remaining participants (80, 25.1%) were neutral.

The employed electronic system supported Arabic and English only as one of the facets of the employed EES, which was supported by a remarkably high number of sample students, in which 259 students (81.7%) agreed. Meanwhile, only 18 students (5.7%) disagreed and 40 students (12.6%) were neutral in their opinions (Table 3).

Another facet that received support from more than 60.0% of the sample students was that the EES provided enough space to enable students to download files. This feature of the EES was confirmed in 196 students (61.5%). In contrast, 56 students (17.6%) had opposing opinions, whereas 67 (21.0%) were undecided (Table 3).

**Table 3.** Sample students' views on flexibility of the electronic education system

| No. | Item | Level of Agreement | | | | |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | *5* |
| 1. | The employed electronic system allows for a large number of students to use it simultaneously. | 25 (7.9) | 41 (12.9) | 50 (15.8) | 147 (46.6) | 54 (17.0) |
| 2. | The electronic education system enables the student to change icons, colors, and interfaces and arrange the content lists according to her/his desires. | 40 (12.5) | 72 (22.6) | 80 (25.1) | 98 (30.7) | 29 (9.1) |
| 3. | The employed electronic system supports the Arabic language and the English language only. | 10 (3.2) | 8 (2.5) | 40 (12.6) | 186 (58.7) | 73 (23.0) |
| 4. | The employed electronic education system provides enough space for enabling the student to download files. | 15 (4.7) | 41 (12.9) | 67 (21.0) | 147 (46.1) | 49 (15.4) |

**Construction and management of examinations.** The third dimension of EES employed in the current study was the construction and management of examination (CME). The feedback of the sample members on the four items of this dimension (Table 4) was also analyzed using the FDA, which revealed the following:

The majority of the sample students (219; 69.8%) agreed that the EES allowed the students to sit for the exams and to automatically correct them (Item 1, Table 4), because 145 students (46.2%) agreed with this and 74 other students (23.6%) agreed strongly with it. In contrast, 49 (15.6%) students disagreed, while 46 students were neutral.

Comparable numbers of the sample members agreed (119; 38.0%) and disagreed (113; 36.1%) with the EES allowing students to create question banks with various types of questions. Eighty-one students (25.9%) were neutral (Table 4). This item is questionable because faculty members, not students, are usually able to create question banks on online education platforms. The finding that the number of students who agreed with this point (Item 2, Table 4) was equal to that of students who disagreed makes this issue controversial and requires further investigation.

The EES website provides feedback on the correct answer, another aspect of SQ that seems to be controversial, although slightly more students agreed than disagreed with it:129 (41.0%) and 115 (36.5%) students, respectively. Meanwhile, 51 participants (16.2%) were neutral in this regard (Table 4).

The EES allows students to upload course assignments on the course page and set the submission date. This conclusion was supported by the finding that 223 students (71.1% of the sample) agreed with this point. Forty students (12.8%) disagreed, while the rest (51; 16.2%) were neutral (Table 4).

**Table 4.** Sample students' views on construction and management of examinations in the electronic education system

| No. | Item | Level of Agreement | | | | |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | *5* |
| 1. | The electronic education system allows the students to set for the exams and to automatically correct them. | 22 (7.0) | 27 (8.6) | 46 (14.6) | 145 (46.2) | 74 (23.6) |
| 2. | The electronic education system allows the students to create question banks. | 51 (16.3) | 62 (19.8) | 81 (25.9) | 82 (26.2) | 37 (11.8) |
| 3. | The electronic education system provides feedback on the correct answer. | 45 (14.3) | 70 (22.2) | 71 (22.5) | 97 (30.8) | 32 (10.2) |
| 4. | The electronic education system allows the students to upload the course assignments on the course page and to setting the date for its submission. | 15 (4.8) | 25 (8.0) | 51 (16.2) | 149 (47.5) | 74 (23.6) |

**Acceptance, storage, and registration management.** Acceptance, storage, and registration management (ASRM) is another aspect of EES employed in the AABU analyzed in this study. The analysis outputs (Table 5) indicate the following.

More than half of the sample members (179; 57.3%) agreed that EES was characterized by the ease of addition and editing of courses (Table 5). This point was agreed upon by 133 students (42.6%) and strongly agreed with by 46 students (14.7%). Meanwhile, 49 students (15.7%) disagreed with this issue, and 84 students (26.9%) were neutral in their position about it.

Almost half of the sample members (164; 53.4%) agreed that EES allowed students to show the course tools and hide them from them. Forty-two students (13.7%) disagreed (Table 5). It is attracting attention that nearly one-third of the students (101; 32.9%) were neutral in their point of view on this issue. This suggests that these students did not experience sufficient EES to discover this feature.

Approximately half of the sample students (148; 47.9%) indicated that EES allowed placement of stopping marks and comments on the content. Sixty-five students (21.0%) disagreed with this, whereas 96 (31.1%) were neutral (Table 5).

The EES employed in AABU provides a glossary of the terms that the course includes, and allows students to add whatever terms they see appropriate is a controversial issue. The FDA (Table 5) disclosed that an equal number of students agreed (107; 34.7%) and disagreed (107; 34.8%). A small number of respondents (94, 30.5%) were undecided. As one-third of the students supported this issue, it may be concluded that either this glossary was not readily visible to the students and/or that most of the students (about two-thirds) did not actually use it; presumably, they did not need it.

**Table 5.** Sample students' views on acceptance, storage, and registration management in the electronic education system.

| No. | Item | Level of Agreement | | | | |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | *5* |
| 1. | The electronic education system is characterized by ease of addition and editing of courses. | 23 (7.4) | 26 (8.3) | 84 (26.9) | 133 (42.6) | 46 (14.7) |
| 2. | The electronic education system allows showing the course tools to the students and hiding those tools from them. | 16 (5.2) | 26 (8.5) | 101 (32.9) | 122 (39.7) | 42 (13.7) |
| 3. | The electronic education system allows placing stopping marks and comments on the content. | 19 (6.1) | 46 (14.9) | 96 (31.1) | 109 (35.3) | 39 (12.6) |
| 4. | The electronic education system provides a glossary of the terms which the course includes and allows the students to add whatever terms they see appropriate. | 44 (14.3) | 63 (20.5) | 94 (30.5) | 74 (24.0) | 33 (10.7) |

**Security and privacy.** The security and privacy of the EES used in the AABU were evaluated from the perspective of university students, using four items (Table 6). These items were subjected to the FDA to probe the students' viewpoints on security and privacy. The analysis results indicate that EES is secure and protects the privacy of users. Specifically,

The vast majority of respondents (272, 89.5%) confirmed that it was not possible to enter EES, except through usernames and passwords. Only 12 sample members (3.9%) disagreed and 20 other students (6.6%) were undecided (Table 6). Therefore, it was concluded that login to the EES was the only way students could enter this system.

A very high number and proportion of the sample students (250; 81.7%) supported the idea that the EES employed by the AABU protects the privacy of students' personal information. A total of 132 students (42.8%) agreed strongly with this and 119 (38.9%) agreed strongly with it (Table 6). However, ten students (3.3%) and nine other students (2.9%) disagreed and strongly disagreed, respectively. Thirty-seven students remained undecided. These percentages confirm that the EES protects the privacy of students' personal information. The EES provides technical ways to provide security and protect students' data from intrusion. This conclusion was reinforced by the FDA results (Table 6), which revealed that approximately two-thirds of the respondents (220, 72.6%) supported this point. A total of 22 students (7.3%) disagreed with this issue, and 61 students (20.1) assumed a neutral position.

Similarly, this study finds that the EES employed in AABU secures the confidentiality of the exam, assignment, and homework evaluation results. This aspect of the system security was supported by 249 students (81.9%). A few students disagreed (nine, 3.0%) and strongly disagreed (nine, 3.0%). Meanwhile, 37 participants (12.2%) were in a neutral position.

**Table 6.** Sample students' views on the security, and privacy of the electronic education system

| No. | Item | Level of Agreement | | | | |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | *5* |
| 1. | It is not possible to enter the electronic education system except through username and password. | 7 (2.3) | 5 (1.6) | 20 (6.6) | 124 (40.8) | 148 (48.7) |
| 2. | The employed electronic education system site protects privacy of the student's personal information. | 9 (2.9) | 10 (3.3) | 37 (12.1) | 131 (42.8) | 119 (38.9) |
| 3. | The electronic education system provides technical ways for providing security and protecting the students' data from any intrusion. | 10 (3.3) | 12 (4.0) | 61 (20.1) | 136 (44.9) | 84 (27.7) |
| 4. | The electronic education system provides confidentiality of the exam, assignment, and homework evaluation results. | 9 (3.0) | 9 (3.0) | 37 (12.2) | 148 (48.7) | 101 (33.2) |

**Learning site content.** In this study, five questionnaire items (Table 7) addressed learning site content (LSC). These items were analyzed using the FDA. The results of this analysis highlighted five main points.

EES uses multimedia such as audio and video files. Of the 138 students, 138 (45.4%) agreed with this aspect, while 84 (27.6%) strongly agreed with it. By contrast, 29 students (9.6%) disagreed (Table 7). In total, 53 (17.4%) were neutral.

EES enables students to manage their educational content and various sources. This feature of EES employed at the AABU was supported by 184 students (60.6%). However, 83 (27.4%) participants were neutral in this regard. In contrast, 25 sample members (8.3%) disagreed with this feature of the EES, while 11 (3.6%) strongly disagreed (Table 7). The possibility holds that the neutral students did not attempt this feature and that the students who negated it did not succeed in managing the educational content.

One hundred and thirty students (42.9%) expressed agreement with the fact that the EES provided updated and new information, whereas 54 (17.8%) strongly agreed (Table 7). However, forty-one students (13.6%) disagreed, whereas 78 (25.7%) had a neutral viewpoint. Consequently, most of the sample students (61.7%) emphasized that the EES provided updated and new information.

Unlike item (3) of the LSC construct, more than 60.0% of the respondents confirmed that EES allows students to manage the educational material, indicating that 132 students (44.0%) agreed with this issue and 52 students (17.3%) strongly agreed with it (Table 7). Only a few students (n = 33, 10.9%) opposed this EES characteristic. By contrast, seventy-two students (23.8%) held a neutral stance.

A noteworthy feature of the EES is that it provides scientific material related to the course and its goals in a timely manner and when needed. The number of students who agreed and strongly agreed were 145 (48.0%) and 52 (17.2%), respectively, constituting 65.2% of all sample members. A few students disagreed (N = 33, 10.9%). However, 72 students (23.8%) were in the neutral position (Table 7).

**Table 7.** Sample students' views on the learning site content

| No. | Item | Level of Agreement | | | | |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | *5* |
| 1. | The electronic education system correctly uses multimedia such as audio and video files. | 10 (3.3) | 19 (6.3) | 53 (17.4) | 138 (45.4) | 84 (27.6) |
| 2. | The electronic education system provides the ability to manage the educational content and its varied sources. | 11 (3.6) | 25 (8.3) | 83 (27.4) | 126 (41.6) | 58 (19.1) |
| 3. | The electronic education system provides updated and new information. | 16 (5.3) | 25 (8.3) | 78 (25.7) | 130 (42.9) | 54 (17.8) |
| 4. | The electronic education system provides the ability to manage educational material. | 18 (6.0) | 27 (9.0) | 71 (23.7) | 132 (44.0) | 52 (17.3) |
| 5. | The electronic education system provides the scientific material related to the course and its goals in a timely manner and when needed. | 16 (5.3) | 17 (5.6) | 72 (23.8) | 145 (48.0) | 52 (17.2) |

## 4.2 Satisfaction

This study evaluated satisfaction with EES using three questionnaire items that addressed three elements of the process: the employed EES (Item 1, Table 8), the educational content (Item 2), and the website employed (Item 3). Hence, the outputs of the FDA can be summarized in the following three major points.

Generally, the sample students were satisfied with the EES employed by AABU. Eighty-seven students (28.5%) were satisfied and 64 others (21.0%) were strongly satisfied with this system (Table 8). By contrast, forty-three students (14.1%) and 52 others (17.0%) were dissatisfied and strongly dissatisfied with the system, respectively. Nearly one-fifth of the sample (59, 19.3%) were neither satisfied nor dissatisfied with the system.

More sample students were satisfied than dissatisfied with the educational content presented in the EES used at the AABU. One hundred and eight students (35.4%) were satisfied and 48 others (15.7%) were strongly satisfied with this content (Table 8). By contrast, 38 students (12.5%) and 39 others (12.8%) were dissatisfied and strongly dissatisfied, respectively. Approximately one-fourth of the sample students (n = 72, 23.6%) were neither satisfied nor dissatisfied with the content.

Comparable levels of satisfaction were observed with the content of the electronic website employed as a vehicle for electronic education at the AABU. Specifically, hundred and two sample students (33.4%) were satisfied and 55 students (18.0%) were strongly satisfied with this content (Table 8). However, 36 (11.8%) and 37 (12.1%) students were dissatisfied and strongly dissatisfied with the content, respectively. Almost one-fifth of the students (75, 24.6%) were neither satisfied nor dissatisfied with the website content. In light of these findings, this study concludes that approximately half of the sample students (49.5%-51.4%) were satisfied with electronic education via the EES used in the AABU (Table 8).

**Table 8.** Sample students' levels of satisfaction with electronic education

| No. | Item | Level of Agreement | | | | |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | *5* |
| 1. | I am satisfied with the employed electronic education system. | 52 (17.0) | 43 (14.1) | 59 (19.3) | 87 (28.5) | 64 (21.0) |
| 2. | I am satisfied with the employed educational content. | 39 (12.8) | 38 (12.5) | 72 (23.6) | 108 (35.4) | 48 (15.7) |
| 3. | I am satisfied with content of the employed electronic website. | 37 (12.1) | 36 (11.8) | 75 (24.6) | 102 (33.4) | 55 (18.0) |

### 4.3 Service quality scores

**Tangible physical features.** Student sample scores on each of the six service quality (SQ) constructs were summed to obtain students' total scores on each of these constructs. Students' total scores on the six constructs were then summed to obtain the total SQ score. By doing so, the original ordinal-scale variables are converted into interval-scale variables on which statistical analysis and testing can be performed. Subsequently, seven descriptive statistics were calculated for the total score. These were the number of respondents, minimum total score, maximum total score, range of total scores, mean total score, Standard Error of the Mean (SEM) total score, and standard deviation (SD) of the total score (Table 9). The TPF construct consists of seven items in the questionnaire that use a five-point Likert scale. Accordingly, the minimum respondent's score is theoretically 7, corresponding to a score of '1' on each of the seven items times seven items (1 × 7 items). The maximum respondent score was 35, which is equivalent to a score of 5 (strongly agree) for each of the seven items (5 × 7 items). As shown in Table 9, the minimum TPF score was 4. A minimum score lower than seven can be ascribed to missing data points; some students may have left some of the seven items without response. In contrast, the maximum score was 35, which was expected. The mean TPF score was 23.48 (Table 9) and the standard deviation (SD) of the total score was 5.676, which was high (much higher than 0). This high SD value reveals wide variations among the sample students in their levels of agreement with the items of the TPF construct. Considering that this study employed a five-point Likert scale for scoring with a midpoint of 3 (neutral), the mean score on the TPF scale was theoretically 21 (i.e., 3 × 7 items). A mean total TPF score of 23.48 means that the average level of agreement of the sample students on the TPF items was slightly above average. Another interpretation of the means can be made based on the agreement classes. This study defined three levels of agreement (low, medium, and high).

Therefore, the mean total TPF score of 23.48 falls within the second interval and, thus, indicates a moderate level of agreement on the TPFs of the EES employed by AABU.

**Table 9.** Descriptive statistics of the sample students' scores on the service quality scales

| Variable | n 1 | Min. 2 | Max. 3 | Range | Mean | SEM 4 | S.D 5 |
|---|---|---|---|---|---|---|---|
| TPFs 6 | 324 | 4 | 35 | 31 | 23.48 | .315 | 5.676 |
| FEES 7 | 319 | 4 | 20 | 16 | 13.99 | .179 | 3.199 |
| CMEs 8 | 316 | 4 | 20 | 16 | 13.37 | .202 | 3.585 |
| ASRM 9 | 313 | 4 | 20 | 16 | 13.10 | .211 | 3.733 |
| SP 10 | 307 | 4 | 20 | 16 | 16.25 | .185 | 3.247 |
| LSC 11 | 305 | 1 | 25 | 24 | 18.20 | .252 | 4.407 |
| SQ 12 | 324 | 9 | 140 | 131 | 95.48 | 1.330 | 23.945 |

1: Number of cases (i.e., number of students); 2: minimum score; 3: maximum score; 4: Standard Error of the Mean; 5: Standard Deviation. 6: Tangible physical features of the electronic education system; 7: flexibility of the electronic education system; 8: construction and management of examinations; 9: acceptance, storage, and registration management; 10: security and privacy; 11: learning site content; and 12: service quality.

**Flexibility of the electronic education system.** The FEES comprises of four items. Following the calculation approach presented in the previous subsection, this study found that the theoretical minimum, maximum, and mean FEES scores were 4, 20, and 12, respectively. The actual total FEES minimum and maximum scores (4 and 20, respectively (Table 9)) are in agreement with the theoretical values. However, the actual mean FEES total score is 13.99 (Table 9), which is somehow higher than the theoretical average score (12), suggesting that the overall level of agreement of the sample students with the FEES items is around average. In addition, the FEES total scores had an SD value of 3.199 (Table 9), which was high (far from 0), suggesting broad variations among the sample members in the levels of agreement on items of the FEES construct.

Low, medium, and high levels of agreement were defined, as described in the previous section.

The mean FEES score was 13.99 (Table 9). Accordingly, students' overall level of agreement with the FEES items was moderate.

**Construction and management of examinations.** The ASRM construct is similar to the FEES and CME constructs as it consists of four items. The theoretical minimum, maximum, and mean total ASRM scores were 4, 20, and 12, respectively. Table 9 indicates that the minimum and maximum total ASRM scores coincided with theoretical scores (4 and 20, respectively). However, the mean total ASRM score was 13.10 (Table 9), which was slightly above the average. Based on the definition of agreement classes introduced in the two subsections earlier, this mean score (13.10) complies with a moderate level of agreement. That is, the level of agreement of the sample students with the ASRM items is moderate. On the other hand, the SD of the total ASRM score was 3.733 (Table 9), which was high and indicative of noticeable differences between the participants in their levels of agreement with the elements of this construct.

**Acceptance, storage, and registration management.** The ASRM construct is similar to the FEES and CME constructs as it consists of four items. The theoretical minimum, maximum, and mean total ASRM scores were 4, 20, and 12, respectively. Table 9 indicates that the minimum and maximum total ASRM scores coincided with theoretical scores (4 and 20, respectively). However, the mean total ASRM score was 13.10 (Table 9), which was slightly above the average. Based on the definition of agreement

classes introduced in the two subsections earlier, this mean score (13.10) complies with a moderate level of agreement. That is, the level of agreement of the sample students with the ASRM items is moderate. On the other hand, the SD of the total ASRM score was 3.733 (Table 9), which was high and indicative of noticeable differences between the participants in their levels of agreement with the elements of this construct.

**Security and privacy.** The SP construct comprises four items in the research questionnaire. Hence, the theoretical minimum, maximum, and mean total scores are 4, 20, and 12, respectively. As shown in Table 9, the minimum and maximum total SP scores matched theoretical values. However, the mean total SP score was 16.25, which is much higher than the theoretical average SP score (12). This indicated that the mean level of agreement with the SP items was high. The standard deviation of the total score was 3.247 (Table 9). This is a high S.D. This finding suggests noticeable variations among sample members in their levels of agreement with the construct items. With reference to the intervals defining the levels of agreement (classes of agreement (low, medium, and high)), it was found that this mean total SP score (16.25) corresponds to a high level of agreement. On this basis, the present study concluded that the students' level of agreement with the SP items was high. In other words, the EES employed at the AABU is secure and protects student privacy.

**Learning site content.** The LSC consisted of five items. The theoretical minimum, maximum, and mean scores are 5 (1 × 5 items), 25 (5 × 5), and 15 (3 × 5), respectively. As Table 9 illustrates, the minimum LSC total score is one, which is much lower than the theoretical minimum score of one. This can be ascribed to missing data points resulting from students skipping some items on the construct. The maximum LSC total score was 25, similar to the theoretical maximum score of this construct. However, the mean LSC total score is 18.20 (Table 9), which is larger than the theoretical mean (15).

Consequently, this study concludes that the level of agreement with the LSC elements is moderate. On the other hand, the SD of the students' total scores on this construct was 4.407 (Table 9), which was high (much higher than 0). This high SD value reveals substantial variations among the sample students in their levels of agreement with the items of the LSC construct.

**Service quality (overall (or total) service quality).** The SQ construct consisted of 28 items, which is the sum of the items of the six individual SQ measures. The theoretical minimum, maximum, and mean scores are 28 (1 × 28 items), 140 (5 × 28), and 84 (3 × 28), respectively. Table 9 shows that the actual minimum score was only nine, indicating that some sample members skipped the SQ items. However, the maximum total SQ score was 140, which agreed with the theoretical score. By contrast, the mean total SQ score was 131 (Table 9), which was much higher than the theoretical mean total SQ score of 84. This indicates a high level of agreement on the quality of the EES that AABU used during the Corona crisis period. However, the standard deviation of the student's scores on this 'total' construct is 23.94 (Table 9), which is quite high a SD. Thus, there were noticeably broad differences among the sample members in their levels of agreement with the 28 items of the SQ construct, which can be expected for a widely varying community of students.

This study found that the students' mean level of agreement with the overall SQ items was high. Stated otherwise, from the perspective of the sample students, the EES employed at AABU was appreciably good quality.

### 4.4. Satisfaction scores

**Satisfaction with the employed electronic education system.** The same approach to interpreting the outputs of the descriptive statistical analysis of the SQ constructs was followed for the interpretation of the results of the statistical analysis of the items of the satisfaction construct (LoS). However, each of the three individual satisfaction constructs comprises only one item. Therefore, the minimum, mean, and maximum theoretical scores on the LoS1, LoS2, and LoS3 scales are 1, 3, and 5, respectively.

In the case of satisfaction with the employed EES (i.e., LoS1), Table 10 highlights that the actual minimum and maximum satisfaction scores agree with the theoretical ones. However, the actual mean satisfaction score (3.22) is slightly higher than the theoretical mean score of 3. The SD of the LoS1 score was 1.368 (Table 10), which is higher than the mean score (3.22). This indicates noticeable differences among participants in their levels of satisfaction with the EES used in the AABU.

To better determine the level of satisfaction of students with the EES, this study defined three levels of satisfaction based on their scores (Low, Medium, and High). Therefore, a mean score of 3.22 corresponds to a moderate level of satisfaction of students with the EES employed in AABU.

**Table 10.** Descriptive statistics of the sample students' scores on the satisfaction scales

| Variable | n 1 | Min. 2 | Max. 3 | Range | Mean | SEM 4 | S.D 5 |
|---|---|---|---|---|---|---|---|
| LoS1 6 | 305 | 1 | 5 | 4 | 3.22 | .079 | 1.380 |
| LoS2 7 | 305 | 1 | 5 | 4 | 3.29 | .071 | 1.242 |
| LoS3 8 | 305 | 1 | 5 | 4 | 3.33 | .071 | 1.246 |
| LoS 9 | 307 | 0 | 15 | 15 | 9.78 | .210 | 3.675 |

1: Number of cases (i.e., number of students); 2: minimum score; 3: maximum score; 4: Standard Error of the Mean; 5: Standard Deviation. 6: Satisfaction with the employed electronic education system; 7: Satisfaction with the employed educational content; 8: Satisfaction with the content of the employed electronic website; 9: Overall level of satisfaction (total satisfaction).

**Satisfaction with the content of the educational website.** Table 10 shows the minimum and maximum scores on the LoS2 scale (satisfaction with the educational content) that agree with their corresponding theoretical values, namely 1 and 5, respectively. However, the mean score for satisfaction with the educational content was 3.29. This indicates that the satisfaction score was close to the theoretical mean of 3. This reveals an average level of satisfaction. Meanwhile, the SD was 1.242 (Table 10), which was considered high (almost one-third of the mean score). From this high SD value, it can be concluded that the sample students differed significantly in their level of satisfaction with educational content. Based on the satisfaction levels (or classes) defined in the previous subsection, it is concluded that the sample university students were only moderately satisfied with the educational content presented to them through the EES used in AABU during the Corona crisis times.

**Overall satisfaction (total satisfaction).** Overall satisfaction with electronic education was a compiled construct comprising three subconstructs (LoS1, LoS2, and LoS3). The theoretical minimum, mean, and maximum scores are 3 (1 × 3 items), 9 (3 × 3), and 15 (3 × 5), respectively. However, descriptive analysis revealed that the minimum score on this scale was 0 (Table 10). This can be attributed to the respondent(s) not providing feedback on one or more of the three items on this scale. However, the actual maximum score (15) is based on a theoretical one. However, the mean overall satisfaction score was 9.78, which was somewhat higher than the theoretical average score. This finding indicated a moderate overall level of satisfaction.

Consequently, a mean overall satisfaction score of 9.78 indicates a moderate level of satisfaction of students with electronic education in AABU during the Corona crisis times. In other respects, the S.D of the overall satisfaction score was 3.675 (Table 10), which was high, implying notable differences among students in their levels of satisfaction.

### 4.5. Correlation analysis

The Correlations between the two variables were of special interest in this study. To this end, a Spearman's Rank Correlation Analysis was performed. This analysis was selected because none of the study variables (TPF, FEES, CME, ASRM, SP, LSC, SQ, or LoS) followed a normal distribution. Regarding the interpretation of the correlation coefficient (pS), this study adopted Taylor's (1990) [17] labeling system to interpret the correlation coefficients (ρS and r). In this system, absolute correlation coefficient values ≤ 0.35 correspond to low correlation; 0.36 to 0.67 denote moderate correlation; 0.68 to 1.0 express high correlation; and ≥ 0.90 represent very strong correlation.

Correlation analysis was performed at a significance level of 0.05. However, significant correlations were detected only at a 0.01 level of significance. The results of the analysis (Table 11) are summarized as follows:

1. There were eight study variables were (TPF, FEES, CME, ASRM, SP, LSC, SQ, and LoS). These eight variables generated 28 associations (Table 11).
2. All associations between the eight study variables were found to be significant and positive.
3. Of the 28 probable associations, 16 associations were strong ($0.68 \leq pS$), while the remaining 12 associations were moderately strong ($0.36 \leq pS \leq 0.67$).
4. The tangible physical features of EES were statistically significant (Sig. = 0.000, which is less than $\alpha = 0.01$), positive, and highly correlated with five variables: FEES ($p = 0.695$), CME ($p = 0.696$), ASRM ($p = 0.670$), SQ ($p = 0.814$), and LoS ($p = 0.699$). However, it had positive medium-strength correlations with LSC ($p = 0.658$) and SP ($p = 0.452$).
5. The flexibility of the EES was statistically significant (Sig. = 0.000), positive, and had high correlations with only two variables: ASRM ($p = 0.681$) and SQ ($p = 0.795$). Associations with the remaining variables were positive and medium in strength: CME ($p = 0.645$), SP ($p = 0.503$), LSC ($p = 0.661$), and LoS ($p = 0.636$).
6. The construction and management of examinations were statistically significant (Sig. = 0.000), positive, and highly correlated with ASRM ($p = 0.703$) and SQ ($p =$

0.812). However, the difference was statistically significant (Sig. = 0.000) and positive, medium-strength correlations with three variables: SP (p = 0.479), LSC (p = 0.638), and LoS (p = 0.575).

7. The acceptance, storage, and registration management were statistically significant (Sig. = 0.000), positive, and highly correlated with the SQ (p = 0.822). There was also an association between medium-strength exercise and SP (p = 0.478), LSC (p = 0.666), and LoS (p = 0.629).
8. Security and privacy are statistically significant (Sig. = 0.000), positive correlation with SQ (p = 0.672), and medium-strength correlation with LSC (pS = 0.601) and LoS (pS = 0.473).
9. The learning site content was statistically significant (Sig. = 0.000), positive, and highly correlated with SQ (p = 0.852) and LoS (p = 0.707).
10. Overall, SQ was statistically significant (Sig. = 0.000), positive correlation, and high correlation with the LoS (p = 0.763). v
11. The overall satisfaction of students (LoS) was more strongly associated with the overall or total SQ (p = 0.763), LSC (p = 0.707), and TPF (p = 0.699) than with the rest of the SQ measures. The weakest association of LoS was with SP (pS = 0.473).
12. Almost all individual SQ measures contributed equally to the overall SQ. However, the contributions of the LSC (p = 0.852) and ASRM (p = 0.822) were the highest. The contribution of SP was the weakest (p = 0.672).

In view of the previous 12 points, it is concluded that the level of satisfaction of the student with electronic education in AABU during the Corona crisis period is influenced the most by LSC and TPF and the least by SP.

**Table 11.**Outcomes of analysis of correlations among the study variables 1, 2, 3

| | | **TPF 4** | **FEES 5** | **CME 6** | **ASRM 7** | **SP 8** | **LSC 9** | **SQ 10** | **LoS 11** |
|---|---|---|---|---|---|---|---|---|---|
| TPF | pS | 1.000 | .695** 12 | .696** | .670** | .452** | .658** | .814** | .699** |
| | Sig. | . | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| FEES | pS | | 1.000 | .645** | .681** | .503** | .661** | .795** | .636** |
| | Sig. | | . | .000 | .000 | .000 | .000 | .000 | .000 |
| CME | pS | | | 1.000 | .703** | .479** | .638** | .812** | .575** |
| | Sig. | | | . | .000 | .000 | .000 | .000 | .000 |
| ASRM | pS | | | | 1.000 | .478** | .666** | .822** | .629** |
| | Sig. | | | | . | .000 | .000 | .000 | .000 |
| SP | pS | | | | | 1.000 | .601** | .672** | .473** |
| | Sig. | | | | | . | .000 | .000 | .000 |
| LSC | pS | | | | | | 1.000 | .852** | .707** |
| | Sig. | | | | | | . | .000 | .000 |
| SQ | pS | | | | | | | 1.000 | .763** |
| | Sig. | | | | | | | . | .000 |
| LoS | pS | | | | | | | | 1.000 |
| | Sig. | | | | | | | | . |

1: Spearman's rank Correlation Analysis; 2: Spearman's correlation analysis; 3: Significance of the test statistic (i.e., probability (p)); 4: tangible physical features of the electronic education system; 5: flexibility of the electronic education system; 6: construction and management of examinations; 7: acceptance, storage, and registration management; 8: security and privacy; 9: learning site content; 10: service quality; 11: overall level of satisfaction. 12: Correlation is significant at the 0.01 level (2-tailed).

## 5. Discussion

Jordanian universities, including AABU, headed towards online education to help their students shift smoothly to e-education by late March, 2020. In this study, the quality of the electronic system was evaluated from the perspective of focusing on the strengths that positively affect EES and weaknesses that need to be studied and scrutinized to formulate solutions to advance the system to higher levels of acceptance by students. The evaluation was also intended to provide information that reflects the reality of how universities deal with e-education to develop their systems in light of the Corona crisis and the associated public closure policy. The students included in this study used the EES at AABU. In other respects, these students represented the three administrative regions of Jordan: south, middle, and north.

This study found that students agreed that the quality of the EES used in AABU was good. The findings of this study are compatible with the results of several studies, such as the study by Leonnard [12] and the study by Ohliati and Abbas [14], in that there are numerous factors that influence the quality of the EES. These researchers pointed out the need to focus on educational content, in addition to the appropriate design of the electronic system website to achieve international quality standards.

Regarding satisfaction with the quality of the educational content, the results of this study are consistent with the results of the studies of Zahia [16] and Saxena et al. [13], which emphasized that educational content has a positive and significant effect on the quality of EES and that continued development of educational content will ensure higher levels of student satisfaction. After analyzing the students' perceptions, a gap was identified between their expectations and the services provided by the AABU. To bridge the gap between students' expectations and actual services, the AABU administration focuses on enhancing their infrastructure and student services in terms of quality. For example, they provide advanced computers and high-speed LAN in university buildings to improve their responsiveness. Owing to the limited budget and large student population, providing each student with their own personal computer or tablet and relevant Internet packages is a challenge that remains unresolved. This is what the results of the study by Zahia [16] emphasized, which touched upon the necessity of providing a suitable environment for e-education for it to continue under emergency conditions like the Corona crisis. It should be noted that the closure episodes that Jordan experienced affected the ability of students' parents to provide them with the basic requirements for enabling them to learn online using an electronic system.

When examining the relationships between the quality of the EES used in AABU and the rest of the variables under investigation, it was found that the8 LSC and ASRM had the highest impact on the quality of this system. By contrast, security and privacy were service quality measures with the lowest influence on the quality of the employed system. This study also found that TPFs, FEES, LSC, and ASRM had positive effects on the quality of EES used in the AABU. For example, students pay most of their attention to the ability of the system to smoothly upload and download multimedia and to the compatibility of EES with different operating systems such as Windows, Unix, and Linux. In addition, the educational website must be designed in such a way as to

fit the nature of the various scientific materials and be characterized by smoothness, clarity, and ease of use.

Regarding the overall level of satisfaction with the EES used by AABU, this study found that the current system is acceptable to universities, as it was found that TPF and LSC have a noteworthy effect on student satisfaction with the EES in AABU. Additionally, the quality of EES positively reflects the level of student satisfaction with the system. The study also found that the S&P factor did not affect the quality of or satisfaction with the electronic system. Thus, we conclude that the variables that affect the quality of EES and student satisfaction are the TPFs and LSC.

The results of this study agree well with the results of the studies of Saxena et.al. [13] since these researchers stressed that the content of the website is one of the most important factors affecting the quality of e-education during the Corona crisis, which, in turn, influences student satisfaction. They also found that the quality of the system, information quality, service quality, and quality of information reception were the factors that most strongly influenced student satisfaction with the quality of e-education. However, Jameel et.al. [11] found that responsiveness, security, and privacy have positive impacts on students' electronic satisfaction and that responsiveness is the most important factor for students' satisfaction.

## 6. Conclusion

The coronavirus crisis affected the whole world and caused disturbances in HEIs, which motivated these institutions to use alternatives to traditional education and head towards e-education. Jordanian universities, including AABU, are no exception. Therefore, the quality of EESs must be evaluated through an analysis of the performance variables that affect the quality of these systems, from a student's perspective.

Shedding light on the variables addressed in this study had a positive impact on efforts to evaluate the quality of EESs and to identify the mutual relationships between them. The results of this study can be used by the university presidency to invest in the development of a flexible educational system that supports e-education and keeps pace with modern technologies.

The results of the present study support the results of previous studies [8], [11], [13], [14], [16] that students' satisfaction with EESs centers on their satisfaction with the content of the educational website, in addition to supporting aspects such as flexibility of the e-education system, content management, exams, and students' conviction that e-education is the best solution for continuing university education under emergency and emerging conditions. We found that students' satisfaction with and quality of EES intersect in highlighting the importance of the TPFs of the system and the content of the educational website in improving the quality of EES and raising the level of students' satisfaction with e-education.

We find that it is the responsibility of the local universities to provide the appropriate infrastructure for the students by making use of the technical learning centers scattered throughout Jordan and the Internet packages that aid the students in carrying out their duties and attending lectures smoothly and at low cost.

Finally, a key limitation of this study was the small sample size. To gain a more comprehensive understanding, future research should consider employing a larger sample size and exploring teachers' attitudes towards the educational system at AABU. Additionally, given the role of parents in remote teaching, it is recommended that the perspectives of parents and teachers be triangulated.

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