ESSAM: AN ASSESSMENT MODEL FOR EVALUATING STUDENTS SATISFACTION IN E-LEARNING ENVIRONMENTS

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Abstract

This paper presents an assessment model for evaluating students' satisfaction in e-learning environments (ESSAM), developed for higher education universities. The model is sufficiently constructed of three hierarchy levels with seven main objectives and 30 sub-criteria. The fuzzy analytical hierarchy process FAHP is used to identify the priority and weights of the model criteria and their sub-criteria. A questionnaire was developed to examine students' satisfaction criteria in e-learning for evaluating the model at King Abdulaziz University, as an applied case study. However, the model is flexible and adaptable, since it can be applied in many other universities. It produces important recommendations for helping universities for achieving demanded e-learning environment services efficiently. The research also aims to achieve the required students' satisfaction criteria that can be used by higher authorities for developing their universities to be remarkable in distance e-learning environments.

Keywords: e-learning assessment models; Fuzzy AHP, critical success factors, learner satisfaction, society support.

1. INTRODUCTION

Nowadays, student satisfaction (SS) has become one of the most demanded goals of e-universities. The SS with online learning is forced by variety of factors, including interaction with the instructor, course structure, and technology. Many scholars have attempted to evaluate SS using: integrated model (Sun, Tsai, Finger, Chen, & Yeh, 2008), (Catalunya, 2014), a hexagonal e-learning assessment model (Ozkan & Koseler, 2009), and a multi-criteria of web-based e-learning systems from the perspective of learner satisfaction. The

assessment of SS with asynchronous and synchronous E-Systems were tackled also in (Wang, 2003 , (Pullen & Snow, 2007), (Shee & Wang, 2008), (Chen, 2012), respectively.

The SS assessment models in e-learning environment are investigated also in several recent articles (Bailie, 2015), (Xiao & Wilkins, 2015), (Cheok, 2015). However, these models are based on limited numbers of SS assessment's criteria that contribute significant part in ESSAM. Hence, it is clear from this review that, there is a needed demand to propose a comprehensive model that integrate and formulate SS evaluating criteria in online learning systems. This model has to take care of additional SS criteria, as introduced in detail in next sections of this paper. The proposed model is used at KAU, as a case study, however it can be applied in many other universities.

The development of ESSAM in e-learning environment will lead to:

a) Develop a model to follow the roadmap of student satisfaction criteria, in the national context and to remain in line with international best practices and ascertain that the academic programs offered by a university are consistent with its mission and goals.

b) Establish a remarkable ranking situation among the international e-university all over the world.

c) Help, university and staff members in decision making for developing academic programs.

d) Periodic assessment reports on effectiveness of the student satisfaction within university (KAU).

These objectives will be achieved by applying SS criteria as proposed in next sections in this paper.

2. LITERATURE REVIEW

The information and communication, available in the technologies' market, offer several benefits to educational area such as: minimize costs, enhance the flexibility of learning, reaching learners, and enabling access to markets (Cole, 2014). These have leaded to the transfer of e-learning from instructor-centric to learner-centric (Xu, Huang, Wang, & Heales, 2014). Because of the number of e-learning applications are increasing rapidly, SS is considered a significant concept cannot be neglected in higher education (Xiao & Wilkins, 2015). In addition, SS become one of the major goals of higher education institutes (HEIs) (Temizer & Turkyilmaz, 2012a). As it was explained in the "five pillars of quality online education", SS is identified as the most important key to continuing learning (Lorenzo & Moore, 2002, (Bailie, 2015). So that HEIs have to spend more effort on the concept of SS in order to succeed and survive in the e-learning competitive area to enhance its figure of merits to meet the expectations and needs of learners.

Many scholars have attempted to evaluate SS. A "fuzzy analytical network process" model for evaluating e-learning systems was proposed (Sadi-Nezhad, Etaati, & Makui, 2010). A model to "examine the relationships among e-learning systems" for university online courses was discussed (Saba, 2012). A "student satisfaction index model" in higher education institutions was implemented (Temizer & Turkyilmaz, 2012a). It is clear from this review that SS assessments' model is still in its formative stage. Hence, this paper proposed a comprehensive model for the evaluation of SS in HEIs. An empirical analysis and implementation; using fuzzy AHP; is developed to evaluate the model, as explained in next sections.

3. METHODOLOGY

The ESSAMs described in previous sections did not achieve all demanded necessarily criteria for determinants, as perceived by students. Because of these models based on limited numbers of main assessment' criteria; (Sun et al., 2008); (McGill, Klobas, & Renzi, 2014); (Aguti, Wills, & Walters, n.d.) ; (Mehregan, Jamporazmey, & Hosseinzadeh, 2011); (Mosakhani & Jamporazmey, 2010), and Martín-Rodríguez et al., 2014). We extended these previous works to suit the recent required criteria for SS in e-learning environment. The ESSAM proposed includes additional important criteria such as the effects of "society support" and "cost support", which are not tackled in any of these previous models.

Fig. 1 shows the ESSAM proposed model. It consists of three hierarchy levels, with seven main criteria, and 30 sub-criteria. These levels and criteria are found to be sufficient and satisfying, since it covers most demanded factors that may influence ESSAM, as described in next sections. Also, the model is flexible, so more criteria can be added to cater for future needs. The model is also adaptable, since its sub-criteria can be updated depending on the e-learning institutes that apply the model. The seven main criteria shown in Fig. 1 includes the following:

Society Support: It is the main criterion that affects student satisfaction in e-learning, since it includes sub-criteria that are very important for helping student success in the society support (Patel, n.d. ,(Anderson, 2008)(Wagner, Hassanein, & Head, 2008). In the ESSAM, we proposed five sub-criteria named A1-A5. Since these sub-criteria have achieved highest scores and students interests in the survey results, and defined as follows:

Attitudes on e-learning & IT (A1), Labor markets' support (A2), Employers' support (A3), Stakeholders' support (A4), and Government rules & regulations (A5).

Student*:* Student success factors in e-learning was discussed in several articles (Kerr, Rynearson, & Kerr, 2006) (Cheok, 2015); (Croxton, 2014). According to survey results, student characteristics included four sub-criteria; named B1-B4 and defined as follows:

Motivation & attitude to e-learning (B1), IT competency & commitment (B2), Learning speed & IT anxiety (B3), and Interactive collaboration (B4).

Course*:* Online course characteristics is one of the most important criteria for the ESSAM model, since "enrollment in online courses is rapidly increasing" and attrition rates remain high (Croxton, 2014). Successful online course has to achieve several requirements as described in (Kennedy, 2014); Grace, Weaven, Bodey, Ross, & Weaven, 2012); and (Krause, 2015) . It is important for the "online instructors, administrators, and course designers to find ways to balance course assignments with the desire to maintain

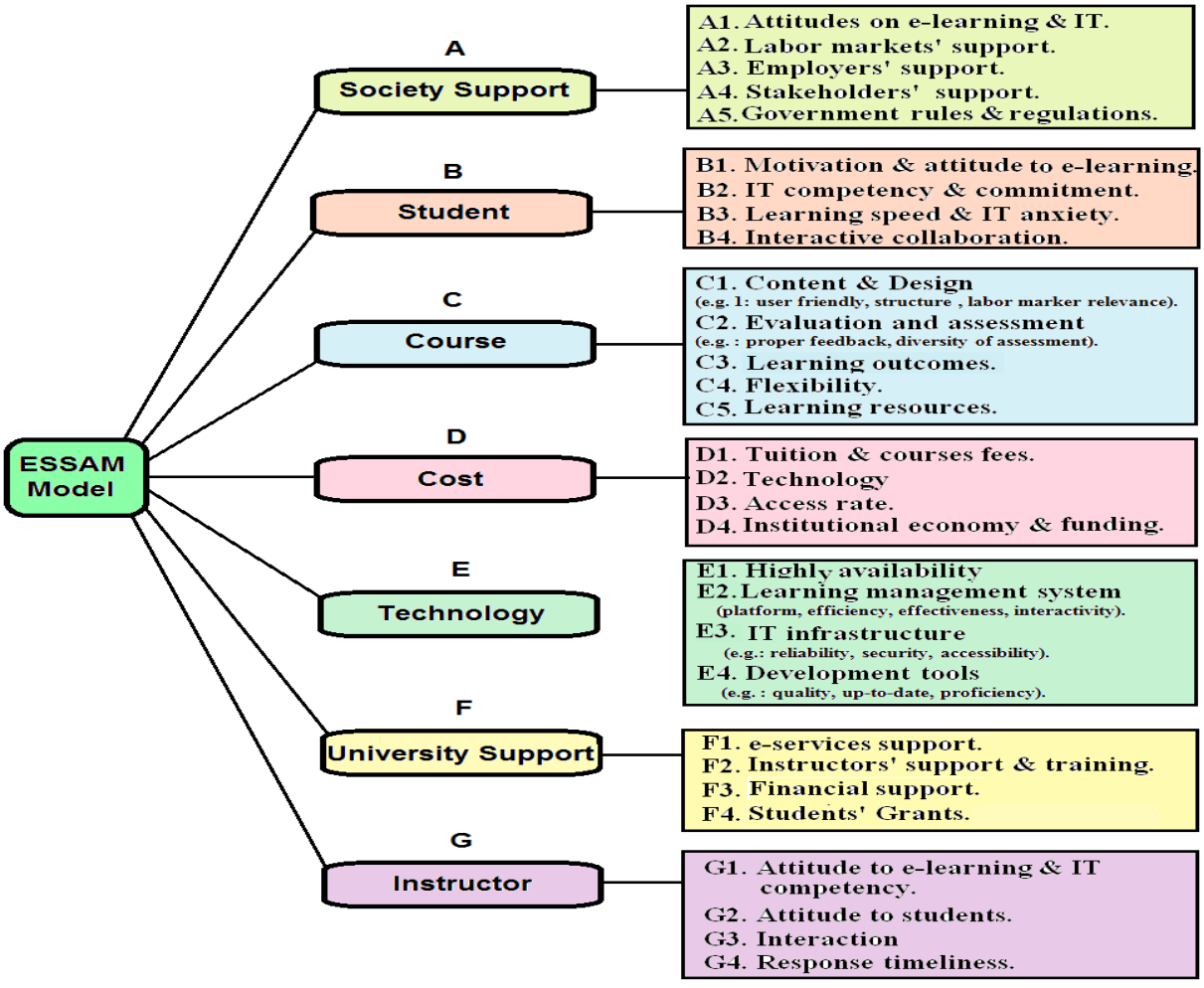

Fig. 1. The ESSAM model proposed**.**

levels of course interaction that are key to student success in online courses" (Temizer & Turkyilmaz, 2012b)(Anthony, 2012) . The suggested ESSAM "course" sub-criteria, due to survey results, are as follows:

Content & Design (C1)- e.g. user friendly, structure, labor marker relevance -, Evaluation and assessment (C2) - e.g. proper feedback, diversity of assessment-, Learning outcomes (C3), Flexibility (C4), and Learning resources (C5).

Cost*:* Institutional economy & funding, tuition & courses fees, cost of both technology and access rate are the most important sub-criteria that reflects on student satisfaction of the acceptance involvement in e-learning. Cost-criteria are investigated in many articles by (Lo, Chang, Shieh, & Chung, 2011) (Rezaie, Nosratabadi, & Fazlollahtabar, 2012). According to these studies, and due to survey results we suggested the following four cost's sub-criteria: Tuition & courses fees (D1), Technology (D2), Access rate (D3), Institutional economy & funding (D4).

Technology*:* The technology that "enables e-learning delivery consists of a broad range of services, from the facilitation of individual distance learning courses, to complete learning management systems" (LMS) such as blackboard (Martin, 2008; Claar, 2014) . The essential sub-criteria that has to be massively achieved for successful eLearning are investigated in many articles by (Ahead, 2013; Shelley, 2008; Martín-Rodríguez et al., 2014; Al-Qahtani, Al-Qahtani, & Al-Misehal, 2013). From these investigations, and due to our survey results we found that the most important technology's sub-criteria for the ESSAM model are the following: Highly availability (E1), Learning management system (E2) -platform, efficiency, effectiveness, interactivity, IT infrastructure (E3),- e.g. reliability, security, accessibility -, and Development tools (E4)- e.g. quality, up-to-date, proficiency.

University Support: The university is the place that co-ordinate for the success of online learning in the "Sevenfold ESSAM model proposed". The e-learning has also encouraged the creation of new, online only educational universities. The essential roles that has to be accomplished by a university in online learning has been investigated in many articles (Joo et al., 2011)(Chou, 2014)(Ibezim, 2013)(Yu, Hamid, Ijab, & Soo, 2009)(McGill et al., 2014). In ESSAM we found, according to survey results that the most effective criteria that have to be considered are the following: e-services support (F1), Instructors' support & training (F2), Financial support (F3), and Students' Grants (F4).

Instructor*:* Instructor plays an important role in the success of online learning. However, there are many criteria that have to be acceptable for a good online instructor. Many of these criteria are explained in (Yengin, Karahoca, & Karahoca, 2011)Croxton, 2014;(Paechter, Maier, & Macher, 2010). In ESSAM, and due to the survey results, the most important five criteria that has to be taken into consideration are the following: Attitude to e-learning & IT competency (G1) , Attitude to students (G2), Interaction (G3), and Response timeliness (G4). The weights and priority estimate of these criteria and their sub-criteria are investigated in next section.

4. DISCUSSIONS

An instrument was developed to collect data of online learning programmes at KAU, as an applied case study. It is based on the Student Satisfaction Inventory (SSI), that achieves high reliability (Levitz, 2014). It contains necessary scales that cover the seven main criteria and the sub-criteria proposed in the ESSAM model.

Four colleges at KAU are included in the survey. The samples of collected data include the main campus of preparatory year students, colleges of Arts, Economics, Business, and master programmes. Fifteen online programmes are covered in the survey. The population of the survey consisted of 8644 females and 5342 male students. Respondents' results are 91% female, and 88% male. Based on these results, weights for the ESSAM main criteria and their related sub-criteria are identified. The fuzzy analytical hierarchy process (FAHP) is used to estimate criteria weights and their priority.

The FAHP is introduced in several articles (Mehregan et al., 2011)(Lupo, 2013)(Kamvysi, Gotzamani, Andronikidis, & Georgiou, 2014). The FAHP approach (Kong & Liu, 2005) is developed, to be implemented using excel sheet template. It gives better results than the AHP method (Golam Kabir, 2011). Because, in AHP when the number of sub-criteria of the hierarchy increases, more comparisons are required. This leads to confusion due to the excess of comparisons, which reduce the efficiency of the model. In such cases, we need to adjust the pairwise matrices' elements and recalculate the consistency test until the required consistency ratio is achieved. Table 1 shows the FAHP pairwise comparison rating scales used to reduce adjusting time needed.

Table 1. **FAHP pairwise comparison rating scales used.**

Scale values	The relative importance of the two sub-elements
0.5	Equally important

0.55 (or 0.5 0.6)	Slightly important
0.65 (or 0.6 0.7)	Important
0.75 (or 0.7 0.8)	Strongly important
0.85 (or 0.8 0.9)	Very strongly important
0.95 (or 0.9 1.0)	Extremely important

Fig. 2 shows the FAHP developed algorithm used to implement the proposed ESSAM model. The overall ratings for each decision sub-criteria for each satisfaction criterion are computed as follows:,

5. FINDINGS AND RESULTS

Table 2 indicates a comparison between different sub-criteria weights related to the criteria and the overall ranking for criteria weights related to the ESSAM model. The values of the column of the ESSAM criteria are calculated by multiplying weights related to the criterion by the weights related to the sub-criteria. For example, 18% x 29.4% = 5.29%, 18% x 21.4 % = 3.86%, 18% x 18.3% = 3.29%, 18% x 16.8% = 3.02%, and 18% x 14.1% = 2.54%, etc. Hence the column of the "Weights to ESSAM" is computed as given in Table 2. The table indicates the sub-criteria of ESSAM weights arranged in ascending order. For example, the sub-criteria: "attitudes on e-learning & IT (A1)" has the first priority in the society support, while the "motivation & attitude to e-learning (B1)" has the first priority in the student characteristics.

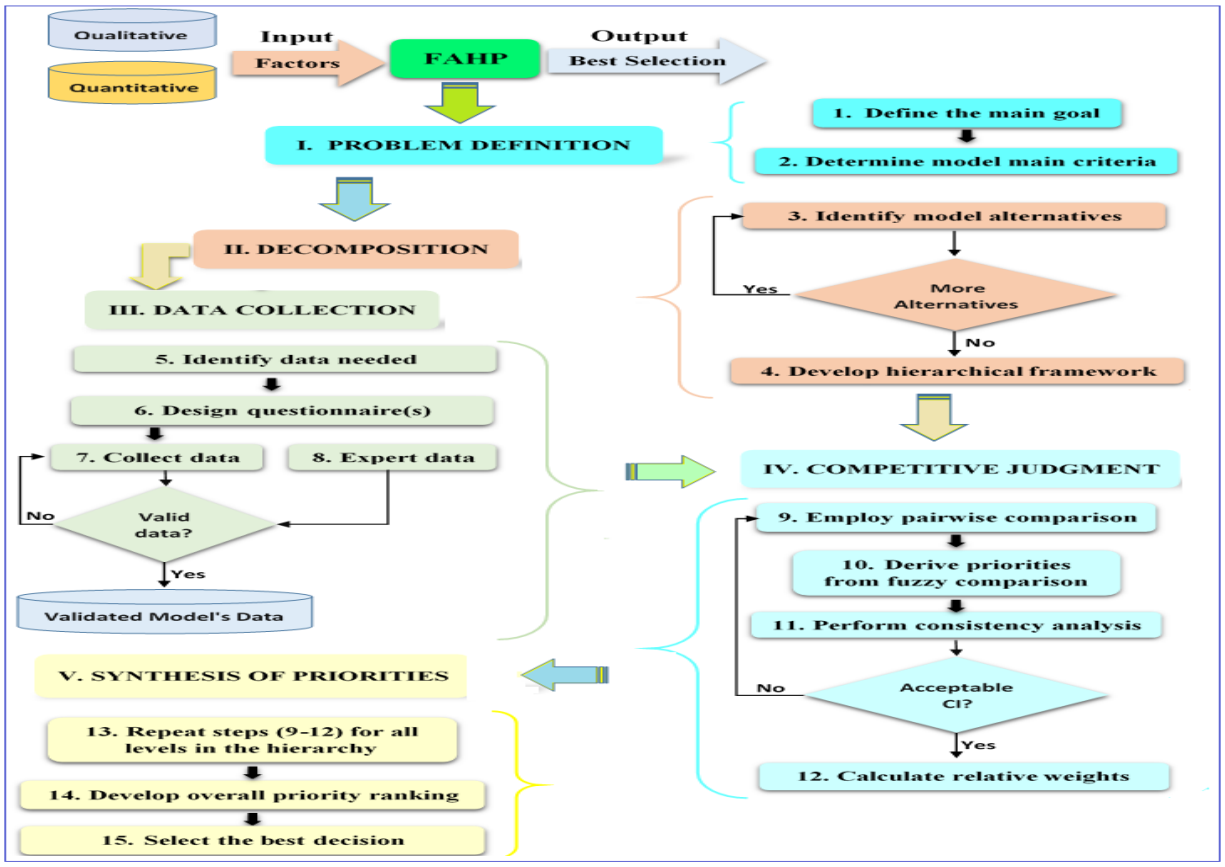

Fig. 2. FAHP algorithm developed for rating each decision sub-criteria for each criterion.

Table 2. ESSAM model main and sub-criteria weights

#	Main Criteria	Sub-criteria	Weights related to criteria	Weights related to ESSAM	Average Weights
1	Society Support 18% A	A1	29%	5.29%	3.60%
		A2	21%	3.86%	
		A3	18%	3.29%	
		A4	17%	3.02%	
		A5	14%	2.54%	
2	Student 17% B	B1	34%	5.83%	4.25%
		B2	24%	4.01%	
		B3	22%	3.79%	
		B4	20%	3.38%	
3	Course 16% C	C1	30%	4.87%	3.20%
		C2	23%	3.63%	
		C3	17%	2.66%	
		C4	16%	2.57%	
		C5	14%	2.27%	
4	Cost 14% D	D1	33%	4.66%	3.50%
		D2	27%	3.76%	
		D3	23%	3.19%	
		D4	17%	2.39%	
5	Technology 13% E	E1	37%	4.75%	3.25%
		E2	28%	3.65%	
		E3	20%	2.63%	
		E4	15%	1.97%	
6	University Support 12% F	F1	37%	4.45%	3.00%
		F2	26%	3.13%	
		F3	19%	2.31%	
		F4	18%	2.11%	
7	Instructor 10%	G1	43%	4.32%	2.50%
		G2	28%	2.82%	

	G	G3	16%	1.60%	
		G4	13%	1.27%	

The main seven criteria: society support (A), student characteristics(B), course (C) , cost (D) , technology(E) , university support (F) , and instructor (G) are ranked as follows: A = 18%, B = 17%, C = 16%, D =14%, E =13%, F =12% and G = 10% due to importance levels, respectively. These findings indicate that "society support" has achieved the highest score with respect to others main criteria that are analysed. Results shown in Fig. 3, indicate that the sub-criteria for the ESSAM model that occupied the first seven positions are the following:

(1) Student "motivation & attitude to e-learning" (B1).

(2) Society support "attitudes on e-learning & IT" (A1).

(3) Course "content & design" (C1).

(4) Technology "highly availability" (E1).

(5) Cost "tuition & courses fees" (D1).

(6) University support for "e-services" (F1).

(7) Instructor “attitude to e-learning & IT competency " (G1).

Universities decision makers have to consider the above results, as recommendations to follow up in order to achieve high SS in the e-learning environment.

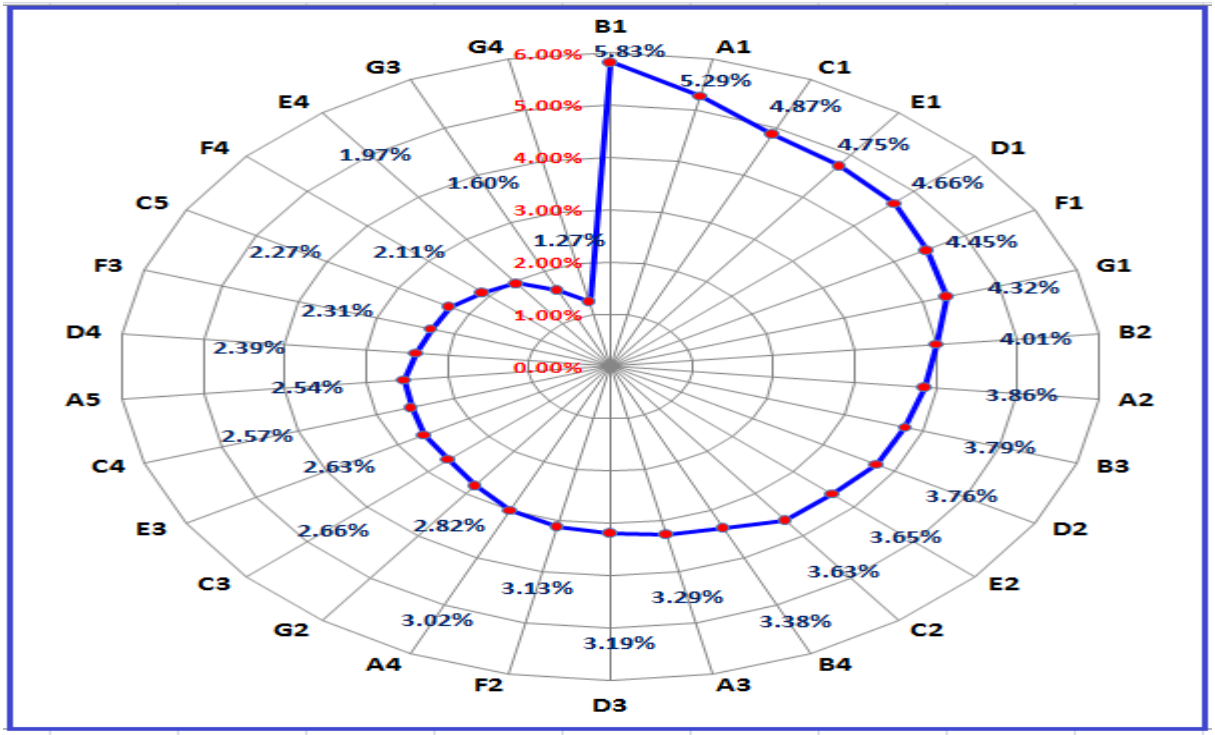

Fig. 3 ESSAM model weights related to each criterion.

CONCLUSION

This paper introduced an assessment model for evaluating students’ satisfaction in e-learning environments "ESSAM". It is sufficiently constructed of seven main criteria, and 30 sub-criteria. The main criteria included: society support, student, course, cost, technology, university support and instructor. Questionnaire was developed; for collecting data from on line learning students' views using the internet; to perform the required assessments. The multi-criteria decision-making fuzzy AHP method was applied to carry out qualitative and quantitative analysis of the model. Results show that the ESSAM model criteria that occupied the first seven positions, to achieve students’ satisfactions in e-learning, are: "student motivation & attitude to e-learning", "society support attitudes on e-learning & IT", "course content & design ","technology highly

availability ", "cost tuition & courses fees", "university support for e-services" and “instructor attitude to e-learning & IT competency", respectively. These results have to be highly recommended factors to follow for improving universities online learning. Although, the model proposed is limited by "numbers and types of questions" raised in the questionnaire. Other universities may modify or add additional questions that suit their stakeholders of online learning. Hence, the model can be considered as a forward step towards achieving a standard ESSAM. For future work, hybrid assessment techniques may also be used, such as combining knowledge discovery data mining techniques with FAHP.

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