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Development and Evaluation of a Web Based System for Students' Appraisal on Teaching Performance of Lecturers

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Abstract: Appraisal of lecturers' effectiveness on teaching performance is an administrative duty of educational administrators which is intended to ascertain whether or not lecturers are performing their duty adequately. Most existing appraisal systems (especially in Nigeria) are superior based thus preventing the students that are direct recipients of lecturers' output to evaluate the teaching competencies of their lecturers. Also, appraisal results that are students' based are reported questionable in terms of its validity and reliability as the outcome of the evaluation reported biased assessment due to lecturers' coercion of students into giving falsified evaluation reports or intentional falsification of judgements about a lecturer by sets of students. This study developed a system for students' appraisal on teaching performance of lecturers (SATP) characterised by support for reduction of students' partiality and prejudice during appraisal on lecturers' effectiveness. Domain Driven Design was employed in designing the SATP client-server architecture and its framework. The SATP was programmed using HTML, CSS, JavaScript and PHP. Afterwards, 60 students were allowed to use the system to evaluate 6 lecturers in computer science department, Federal College of Wildlife Management which serves as the purposively selected research domain. The evaluation data obtained from the system were statistically evaluated to determine SATP performance (suitability, effectiveness and ability to detect falsified evaluation) using t-test at 0.10 level of significance. The results of performance evaluation revealed that SATP was found to be visually suitable and effective for lecturers' evaluation. More so, evaluation data reported as not been falsified by SATP also recorded insignificant differences ($\Delta\mu = 0.36$, $p>0.10$) in first and second evaluation while evaluation data reported as been falsified by SATP recorded significant differences ($\Delta\mu = 12.22$, $p<0.10$) in first and second appraisal (evaluation). The study concluded that the result of evaluation of lecturers retrieved from the

developed SATP is valid and recommend the adoption of the system in tertiary institutions as it will improve the excellence of educators and academics in tertiary institutions.

Index Terms: Appraisal, Evaluation, Teaching Competencies, Teaching Performance

1. Introduction

The proliferation of software applications, mobile devices with wireless capabilities, increasing access to the internet and reduction in the cost of internet access has enabled computer systems to find increasing applicability [1]. Nowadays, computers have been adopted to support many aspects of education including computer aided instruction, instruction recordings, provisioning of assistive technology for the disabled, delivery of learning, training, or educational program by electronic means using computer network and internet in some way to provide or support training, educational or instructional material using myriads of computing devices [2].

It is the contention of this study that ICTs can also be annexed to provide feedbacks to government, educational actors and policy makers, parents of students and school authority on results of lecturers' appraisal from students' judgement. This is important because lecturers differ in their abilities and aptitudes. There is always difference in the quality and quantity of the same lecture delivered by two different lecturers. Therefore, performance appraisal of lecturers is necessary to understand each lecturer's abilities, competencies, relative merit and relative worth to an educational institution. Performance appraisal rates the lecturers in terms of their performance.

In the educational institutions, continuous performance appraisal of lecturers is important to find out whether lecturers are improving or not and to know the perspective of the students about their style of delivering lecture. In similar vein, lecturers want to know how well they perform on the job. Furthermore, the need for performance appraisal of lecturers in Nigerian educational institutions is not far-fetched, as students' under-performance at all educational levels in Nigeria has been a much discussed educational issue and at the heart of solving the problem of students' underperformance is the need to understand its causes. Many causes or agents have been studied as the etiological starting point for investigating the phenomena of school failure or success.

[3] gathered that these causes are looked into from several perspectives including the role of the students, teachers, parents or family, school environment, society, government. Some works that concern lecturers among these are effects of: attitudes of lecturers to continuous assessment [4,5,6,3], teachers' teaching methods [7,8] and teachers' competencies [9,10].

From the foregoing, these causes can be linked to the effectiveness/competencies of teachers/lecturers, meanwhile at the heart of solving the problem of students' underperformance is the need to allow the students to periodically carry out seemingly continuous lecturers' appraisal as the students are the direct recipients of the lecturers' discharge of duties. As such there is need to enable students to be given the chance to provide insight to what some lecturer(s) is/are doing that is affecting their rates of learning so as to provide feedback to ways by such lecturer(s) can improve their method of instruction thus the need for appropriate system for Students' Appraisal on Teaching Performance of lecturers. Several researches have been carried out to develop such system, however some of the earlier studies were criticised of making it impossible to distinguish great teaching from good teaching because they were based on only two (2) possible ratings (satisfactory or unsatisfactory) while some were criticised of taking a lot of time or giving results that were manipulated. Later studies were rigid as staff appraisal is only done seasonally and results were only obtained only at the end of the whole exercise [11].

1.1 Aim and Objectives

Sequel to [11] this study aims to implement a web based system for students' appraisal on teaching performance (SATP) of lecturers in higher institutions in Nigeria and evaluate the reliability and validity of the outcome of appraisal done by students using SATP. The specific objectives include:

i. To implement and develop a prototype of the SATP software based developed
ii. To pilot test the prototype of the SATP software developed in computer science department, Federal College of Wildlife Management, New Bussa
iii. To evaluate the ability of the SATP to detecting falsified appraisal on lecturers by set(s) of student(s)
iv. To validate the suitability and effectiveness of data generated by the SATP for continuous periodic appraisal of lecturers

2. Previous Studies

Students' appraisal or evaluation on performance in classroom teaching is not recently introduced into the world of education. As a matter of fact, the initiative taken to evaluate teaching has started as early as the 1915 [12]. According

to [12], the first teacher rating scale was published in 1915 and the first study of students' evaluation of teacher effectiveness was written in the 1920s. For many decades, the outcome of students' evaluation of teaching performance is seen as an important tool to measure the effectiveness of teaching quality. It has been used to reflect on qualities associated with good teaching such as lecturers' knowledge, clarity, classroom management and course organization.

Despite the fact that students' evaluation of lecturers' performance is not a recent phenomenon, extensive research by psychologists and educators have consistently reported that students' evaluation on performance were questionable in terms of its validity and reliability. The outcome of the evaluation was reported biased as the student assessed the teaching performance based on non-related learning measures which included race, gender, political ideology, socio-economic status, attractiveness [13, 14, 15, 16]. In other instances, students' evaluations were reported influenced by the lecturers' smiles, gestures and other mannerisms, rather than the lecturers' knowledge, clarity, organization or other qualities associated with good teaching [17]. These critics felt that this type of evaluations were not useful as the ratings that students awarded did not bear any relationship with objective measures of learning or what educators accomplished in the classroom. To overcome this problem, this study validates the responses of the students by adopting pre-test, post-test design which will be statistical analysed to test the consistency of the students' responses.

According to [18], teachers were rated based on two possible ratings, satisfactory or unsatisfactory, in previous teacher evaluation systems. This system made it impossible to distinguish great teaching from good, fair or poor teaching. Consequently, it was also difficult to conclude if teaching expectations were met or to identify specific lecturers that need additional support tailored to their specific needs. To overcome this problem, the instrument used in this study to evaluate the lecturers' performance were given 5 rating scale namely A: Excellent; B: Good; C: Satisfactory; D: Fair; F: Poor. The scale enabled the students to perform ratings from the most ineffectiveness to the highly effectiveness of the lecturers' characteristics been measured. This would give the lecturers and the learning institution a clearer picture of the performance assessed by the students. The lecturer concern would be able to know whether expectations were met and the managing directors can be provided with clear information to support their decisions.

More specifically, [19] worked on the Design and Implementation of Lecturer Evaluation System Using ELECTRE Method in Web-based Application. They created a Lecturer Evaluation System by Students using Elimination et Choix Traduisant la Realite (ELECTRE) method to assist and facilitate in making decision related to lecturer's evaluation to get the best lecturer's recommendation. However, their design raised some challenges:

i) There are students who do not fill out the questionnaire form completely hence the evaluation process becomes ineffective and there is a possibility that data obtained is not valid.
ii) Evaluation activities of lecturers take a lot of time, because the procedure used has long stages. In addition, there are often lecturers in the classroom without any students or the number of students who attend just a little.

Careful study of the method adopted also shows that the method expected all students to evaluate each lecturer before decision is made using the ELECTRE method about the particular lecturer, thus the rationale behind the challenges they faced. Furthermore, their design tends to focus on getting best lecturer rankings and does not give in-depth details about lecturers' general attitude to students in classroom. To overcome this, this study allows analysis of the data (students' responses) to be possible as at when needed once one or more students have evaluated a particular lecturer. Furthermore, results of analysis on individual lecturer generated as a report contains in-depth details about lecturers' general attitude to students in classroom.

3. Methodology

The research employed the experimental domain driven methodology in the design of the framework, implementation of the designed framework through development of a prototype SATP and employed the quasi-experimental methodology in the evaluation of the system based on system specification in [18] explained in earlier section (however, with further enhancement of limitations therein).

3.1 System Design

As earlier stated, this paper is a sequel to [11], hence the design of the system was based on the requirement and specification that has been judiciously analysed in [11], therefore to focus on the aim of this paper, details of the system analysis and design will not be delved into as such, only the users' activities/navigations in the system developed is reported in this section. From a design point of view, the system includes only two domain specific stakeholders' navigations as depicted in figure 1:

i) Admin Navigation
ii) Student Navigation

The System Admin through the admin navigations is enabled to perform following functions:

i) Admin Authentication (LOG IN)
ii) Add and Edit Lecturers' data
iii) Add and Edit Students' Matriculation numbers
iv) Add and edit questionnaire items
v) View results of students' appraisal on certain lecturer(s)

The students on the other hand through the students' navigations are enabled to perform following functions:

i) Complete registration process
ii) Students' authentication
iii) View lecturer data
iv) Appraise Staff (Conduct pre-test and post-test evaluation on certain lecturer)

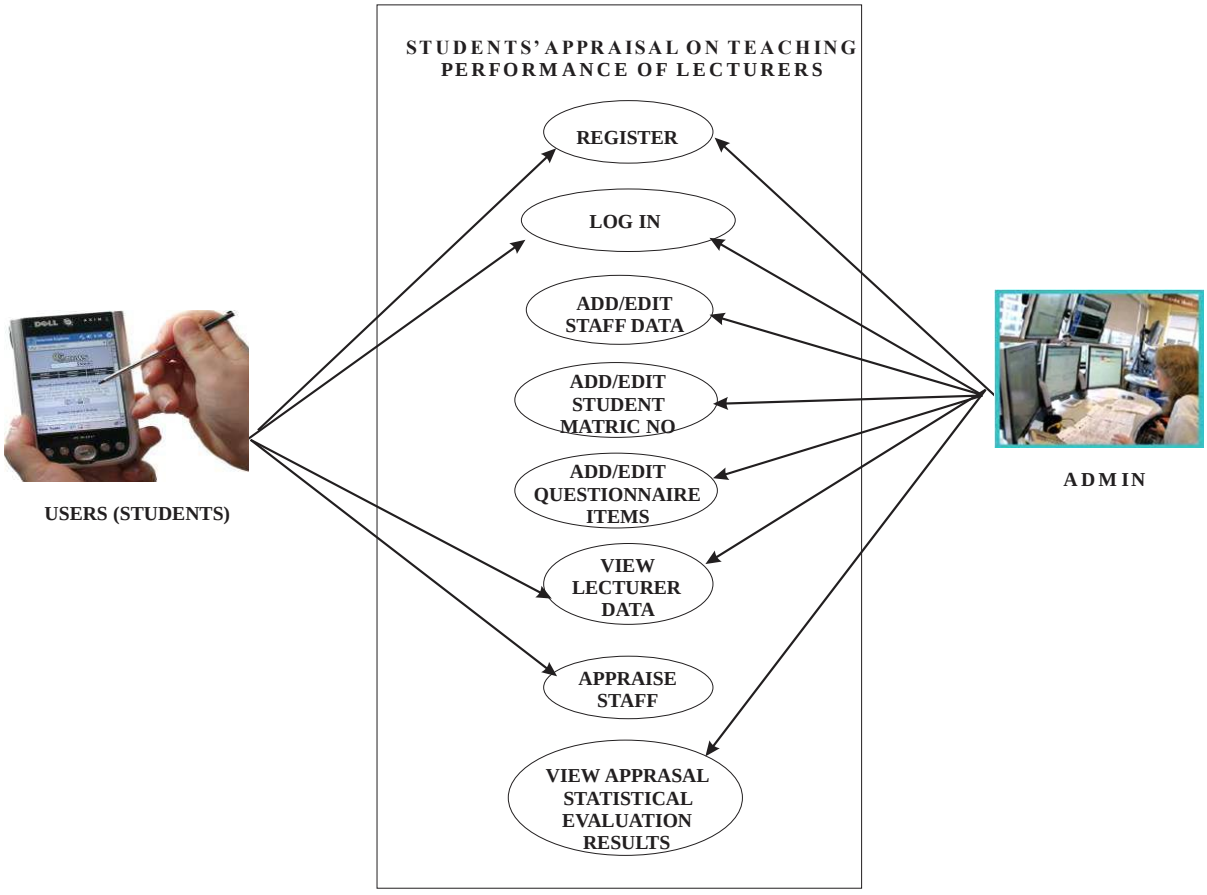


Fig. 1. Use case diagram of the SATP system

The system allows admin to be authenticated. After authentication the system presents options to enter the lecturers' data and register the students' matriculation numbers alone to ensure only valid students are allowed to use the system. Also, the admin is able to enter and edit appraisal questionnaire items. Afterward, students whose matriculation numbers are in the database complete their registration processes themselves. Each registered student is given link to view basic data of lecturers he or she has been under his/her lectures before as determined by the base model of the system (described in section 3.2) and it is only on such lecturers each student can conducts pre-test appraisal on. After a while, the students are given links to conduct post-test appraisal on the same lecturer(s) they have conducted pre-test appraisal on alone. During submission of each post-test appraisal data, the system's base model determines statistically whether the appraisal data is to be disqualified or accepted and the appraisal data is included among the appraisal data on the appraised lecturer only if the appraisal data submitted is not disqualified.

3.2 System Implementation

The research instrument used in this study was the prototype Students' Appraisal on Teaching Performance (SATP) System developed as client server system. The client side interface was developed using Hypertext Mark Up Language

(HTML5), CSS and JavaScript while the server side was developed using Personal Homepage Preprocessor (PHP) scripting language running on Apache Server that interacts with the MySQL server as backend. The interface of the pre-test/post-test evaluation webpage of the SATP system was developed using a 5- point likert scale questionnaire that allows the students to select and evaluate selected lecturer as depicted in figure 2.

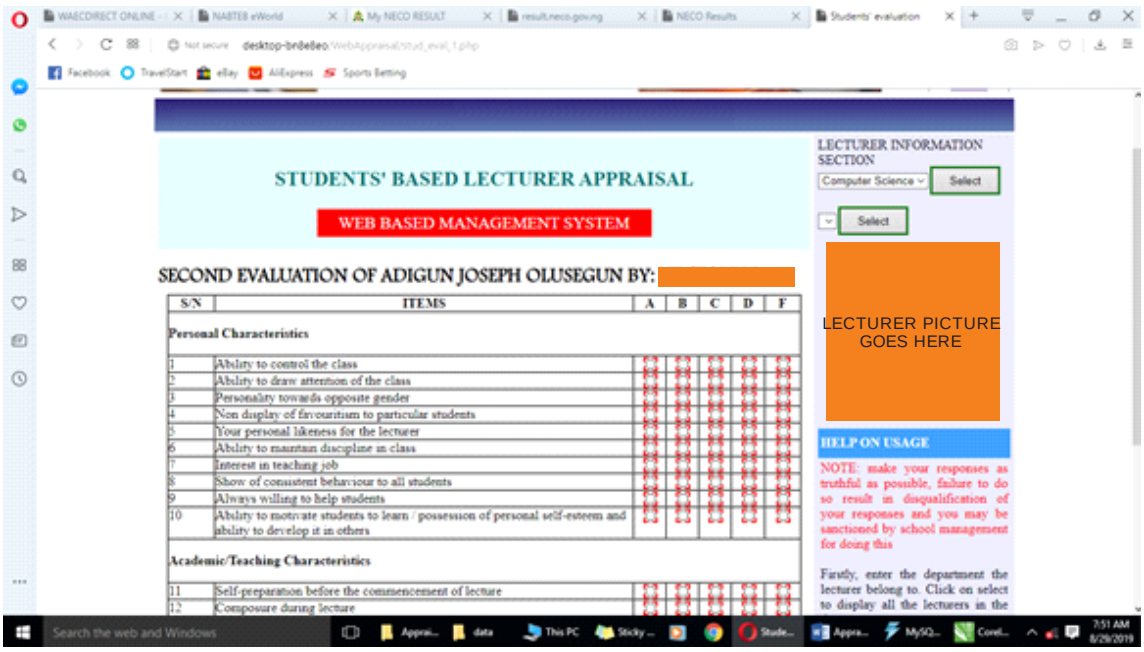


Fig. 2. Students' appraisal of lecturers' webpage

The base model of the system is incorporated into the first evaluation (pre-test), second evaluation (post-test) webpages and the evaluation results printing web page. The base model was developed to run on Apache server using Personal Homepage Pre-processor (PHP) scripting language.

The base model incorporated into the first (and second) evaluation webpage accept and weigh students' evaluation data on a lecturer using frequency counts, percentages and means score and mean deviation based on Eq. (1) and Eq. (2).

$$\mu_0 = \frac{\sum_1^{n_s} X_i}{F} * 100\% \tag{1}$$

$$M.D = \frac{\sum_1^{n_q} X_{i-d}}{n_q} \tag{2}$$

The mean deviation is an initial discriminatory test to determine whether or not a student just selected the same rating value on a lecturer for all variables measured. A mean deviation of less than ±0.02 renders an evaluation to be disqualified.

Where

i = case "i" which represents a particular character traits/attribute expected of a lecturer
X_i = rating value of the variable for attribute "i" of a lecturer as rated by a student
n_q = Numbers of variables (i) been measured on a lecturer that is, number of questionnaire items
μ = mean rating of a lecturer as gotten from responses of a particular student that have evaluated quality of attribute of a lecturer
d = average rating value of a student on a particular lecturer
n_s = Number of students that rated a lecturer
*F = Total rating value expected of a lecturer given multiple of d * n_s*
μ_0 = Evaluation percentage of a lecturer as derived from responses of entire students that evaluated the said lecturer

The base model incorporated into the second evaluation (post-test) webpage validates originality of the responses of the students, any evaluation on a lecturer by a student that is not conducted first and second time is automatically disqualified. When a student submits second evaluation on a lecturer, difference of mean statistics is conducted on the

pre-test and post-test response on the lecturer to determine consistency of the students' response. A mean error (μ_d) value is generated and any mean error value above 1.0% is rejected as invalid. This is expected to prevent random evaluation response from students. The mean error is calculated using Eq. (3).

$$\mu_d = \left| \frac{\sum_1^{n_q} X_{1i} - X_{2i}}{5 * n_q} * 100\% \right| \quad (3)$$

The base model incorporated into the evaluation results printing web page retrieve contents of database and enable managers and decision makers to make decision based on appraisal data on a lecturer, it therefore gives the system administrator ability to generate appraisal results for lecturers individually and collectively.

3.3 Settings and participants for pilot testing

This study adopts a domain driven design with no special treatment given to the subjects and without a control group using a multi stage sampling technique, furthermore, in order to obtain a precise and concise data for the study, purposive sampling technique was used at all stages. As such, Federal College of Wildlife Management was purposively selected as the study area to ease data collection because the researchers work there. More so, at the second stage, students of computer science department were used as the appraisers while the researchers (been lecturers in the department) were used as the appraisee, six (6) lecturers were involved in the study.

Federal College of Wildlife Management awards National Diploma and Higher National Diploma degrees. However, Computer Science department being a recently introduced department in the college only award National Diploma (ND) at the period this study was conducted. The study therefore involves National Diploma (ND1 and ND2) students of the selected department. The study involved only one study group (x-treatment) in which case the treatment is the usage of the developed SATP system. The administrator entered the entire students' matriculation numbers to ensure only students of the department had access to register to use the online system while at the same time ensure a one-to-one correspondence evaluation of each lecturer (disallow multiple evaluation of a lecturer by one student).

The students were further gathered together and given instructions on procedure for registration and pre-test appraisal. Afterward, they were given the link to register and instructed to conduct pre-test appraisal on each lecturer. This was done within two (2) to three (3) days after which the link was disabled for access. After a period of two weeks, the students were given the link to conduct post-test appraisal on the same lecturers they have conducted pre-test appraisal, this was also done within two (2) to three (3) days after which the link was also disabled for access.

In order to ascertain the willingness of the students to appraise their lecturers, the students were not forced to participate in the appraisal of the lecturers they wish to appraise, however, the students were duly informed that the system was made to statistically discover fraudulent appraisal on any lecturer(s) but were not told how the system will discover this. They were therefore implored to give correct appraisal on each lecturer to the best of their knowledge. The quasi-experiment test/determines whether the result of evaluation from the SATP system would be valid if the students were forewarned that the system is able to detect and disqualify their appraisal data on a lecturer, this is done to afford high qualification rate of the students' appraisal. The study was conducted between January 2021 and February 2021.

3.4 System Evaluation Method

The system performance evaluation was conducted to provide confidence that the developed software solution met both the functional and non-functional requirements by verifying the suitability and acceptability (to the students) of the developed system while at the same time verify the validity of the appraisal data. The study was based on the following assumptions:

i) The developed SATP allow students (the direct recipients of lecturer's productivity) to evaluate their lecturers
ii) The developed SATP allow for flexible retrieval of appraisal data anytime it is needed
iii) The design of the SATP reduces falsification of judgments about a lecturer by sets of student(s)
iv) The developed SATP appraisal result is valid

Based on the assumptions, the study is guided by the following research hypotheses:

- $H_0$1: The reports generated by SATP is not suitable nor effective significantly for conducting appraisal on teaching performance of lecturers as at when needed
- $H_0$2: The system will not detect statistically detected falsified evaluation data on lecturers significantly
- $H_0$3: The rate of falsified evaluation by students will not significantly reduce even when informed of possible rejection of appraisal data by the system

Visualization of data generated by the system were used to judge the effectiveness and suitability of the system for continual lecturer appraisal whose data can be retrieved as at when due. Furthermore, data collected during pilot testing of the developed system were presented and further analysed using descriptive (frequency counts and percentages) and inferential (paired sample t-test) statistics with the aid of Microsoft Excel and Statistical Package for Social Sciences (SPSS).

4. Results and Discussion

4.1 Personal Characteristics of respondents

Table 1 described the appraisers and the appraised lecturers briefly. Responses presented in table 1 show that 46 (63.0%) of the appraisers (students) were in National Diploma Level 1 (ND1) while the remaining 27 (37.0%) were in National Diploma Level 2 (ND2). Five (5 representing 83.3%) of the appraised lecturers were males while only one (1 representing 6.7%) was female and a total of six (6) lecturers were appraised. It went on to show that the total number of students that initiated registration process were sixty (60 representing 82.2% of the students' population). The number of appraisal records expected to be retrieved when sixty (60) students conducted evaluation on six lecturers was three hundred and sixty (360) during each evaluation phase (that is, first or second evaluation). However, three hundred and fifteen (315 representing 87.5% of expected evaluation records) were retrieved during first evaluation while one hundred and ninety-two (192 representing 53.3% of expected evaluation records) were retrieved during second evaluation.

Table 1. Frequency distribution of students and lecturers

Variables		Frequency	Percent
Class/Level	ND1	46	63.0%
	ND2	27	37.0%
	Total	73	100%
Gender of lecturers	Male	5	83.3%
	Female	1	6.7
	Total	6	100.0
Appraisal record breakdown	Students that registered	60	82.2%
	Pre-test Appraisal records retrieved	315	87.5%
	Post-test Appraisal records retrieved	192	53.3%
	Appraisal records expected each phase	360	100%

4.2 Data Analysis

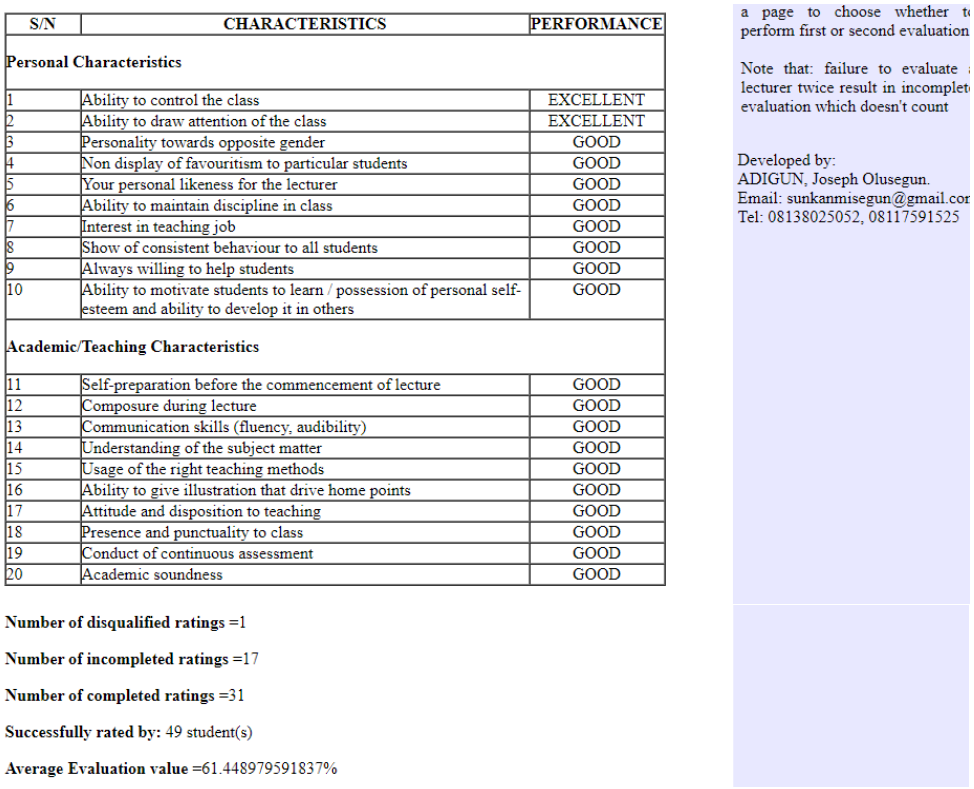
The result presented in figures 3 (a) and 3 (b) are used to test the suitability of SATP, that is, hypothesis 1.

$H_0$1: The reports generated by SATP is not suitable nor effective significantly for conducting appraisal on teaching performance of lecturers as at when needed

Screenshot visualizations of sample appraisal reports of two (2) lecturers are presented in figures 3 (a) and 3 (b) to explain suitability and effectiveness of the developed SATP system through visualization results generated. It shows the various data generated by the system including performances of each lecturer based on some personal and academic (teaching) characteristics and the numbers of disqualified, uncompleted, completed ratings, numbers of ratings initiated and average evaluation values on each lecturer.

In figure 3 (a), 49 (out of 60) students initiated evaluation on lecturer 'A', 31 (63.3%) out of the 49 students completed the second evaluation and only 1 (3.22%) of the completed evaluation data was disqualified or rejected, ultimately lecturer 'A' had a total evaluation value of 61.45%.

Conversely, figure 3 (b) shows that 52 (out of 60) students initiated evaluation on lecturer 'B', 31 (59.6%) out of the 52 students completed the second evaluation and only 3 (9.68%) of the completed evaluation data was disqualified or rejected. Ultimately lecturer 'B' had a total evaluation value of 56.15%.



S/N	CHARACTERISTICS	PERFORMANCE
Personal Characteristics		
1	Ability to control the class	EXCELLENT
2	Ability to draw attention of the class	EXCELLENT
3	Personality towards opposite gender	GOOD
4	Non display of favouritism to particular students	GOOD
5	Your personal likeness for the lecturer	GOOD
6	Ability to maintain discipline in class	GOOD
7	Interest in teaching job	GOOD
8	Show of consistent behaviour to all students	GOOD
9	Always willing to help students	GOOD
10	Ability to motivate students to learn / possession of personal self-esteem and ability to develop it in others	GOOD
Academic/Teaching Characteristics		
11	Self-preparation before the commencement of lecture	GOOD
12	Composure during lecture	GOOD
13	Communication skills (fluency, audibility)	GOOD
14	Understanding of the subject matter	GOOD
15	Usage of the right teaching methods	GOOD
16	Ability to give illustration that drive home points	GOOD
17	Attitude and disposition to teaching	GOOD
18	Presence and punctuality to class	GOOD
19	Conduct of continuous assessment	GOOD
20	Academic soundness	GOOD

Number of disqualified ratings =1

Number of incompleted ratings =17

Number of completed ratings =31

Successfully rated by: 49 student(s)

Average Evaluation value =61.448979591837%

a page to choose whether t
perform first or second evaluation

Note that: failure to evaluate
lecturer twice result in incomplet
evaluation which doesn't count

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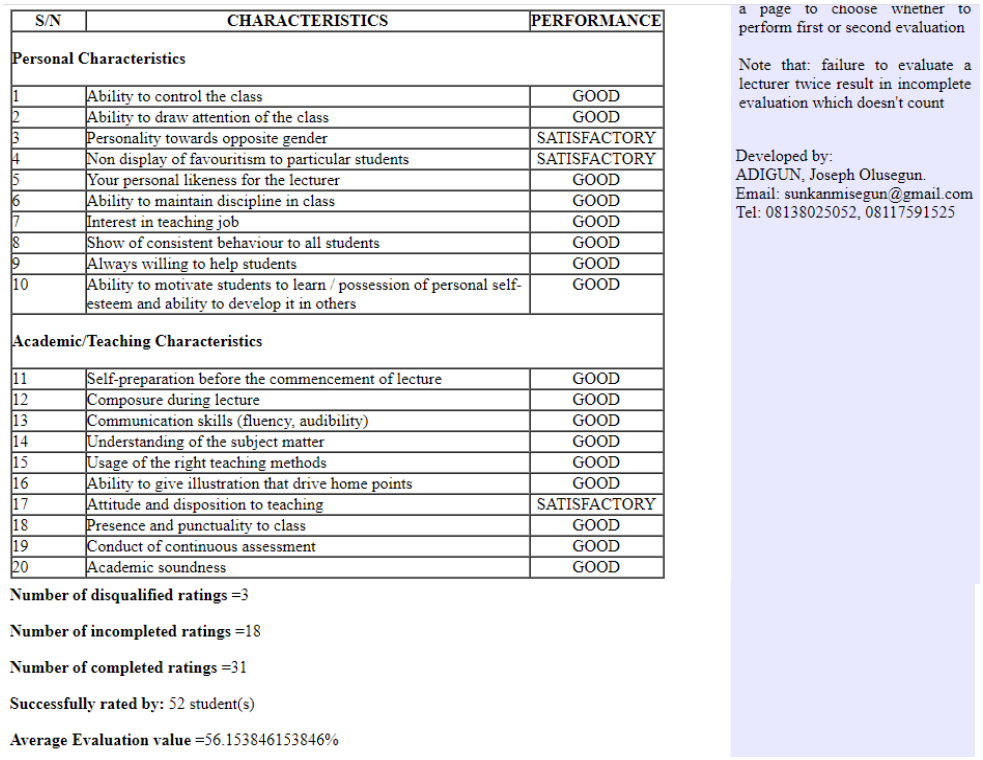
Fig. 3 (a). Evaluation reports of lecturer 'A' showing suitability of SATP system



S/N	CHARACTERISTICS	PERFORMANCE
Personal Characteristics		
1	Ability to control the class	GOOD
2	Ability to draw attention of the class	GOOD
3	Personality towards opposite gender	SATISFACTORY
4	Non display of favouritism to particular students	SATISFACTORY
5	Your personal likeness for the lecturer	GOOD
6	Ability to maintain discipline in class	GOOD
7	Interest in teaching job	GOOD
8	Show of consistent behaviour to all students	GOOD
9	Always willing to help students	GOOD
10	Ability to motivate students to learn / possession of personal self-esteem and ability to develop it in others	GOOD
Academic/Teaching Characteristics		
11	Self-preparation before the commencement of lecture	GOOD
12	Composure during lecture	GOOD
13	Communication skills (fluency, audibility)	GOOD
14	Understanding of the subject matter	GOOD
15	Usage of the right teaching methods	GOOD
16	Ability to give illustration that drive home points	GOOD
17	Attitude and disposition to teaching	SATISFACTORY
18	Presence and punctuality to class	GOOD
19	Conduct of continuous assessment	GOOD
20	Academic soundness	GOOD

Number of disqualified ratings =3

Number of incompleted ratings =18

Number of completed ratings =31

Successfully rated by: 52 student(s)

Average Evaluation value =56.153846153846%

a page to choose whether to
perform first or second evaluation

Note that: failure to evaluate a
lecturer twice result in incomplete
evaluation which doesn't count

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Fig. 3 (b). Evaluation reports of another lecturer 'B' showing suitability of SATP system

The results of statistical analysis presented in tables 2 and 3 serves to test the hypotheses 2 and 3 stated.

Tables 2 (a) and 2 (b) show paired sample t-test performed to test the differences in first and second appraisal (evaluation) of evaluation data that were accepted and the ones rejected by the SATP respectively. This was used to test whether or not SATP would reject similar data that will be rejected by paired sample t-test.

Table 3 (a) and table 3 (b) are used to test whether or not falsified evaluation by students will be significantly reduced when the students are informed of possible rejection of appraisal data by the system. The rate of disqualification of determined falsified evaluation by the SATP is presented in table 3 (a) while table 3 (b) shows the test of difference between acceptance rate and disqualification rate of students' evaluation.

$H_0$2: The system will not detect statistically detected falsified evaluation data on lecturers significantly

Table 2 (a). Differences in first and second evaluation for accepted appraisal data

Variables	Mean	Mean difference	p-value
First Evaluation Mean Score	91.42	0.36	0.426
Second Evaluation Mean Score	91.79		

Table 2 (b). Differences in first and second evaluation for disqualified appraisal data

Variables	Mean	Mean difference	p-value
First Evaluation Mean Score	87.33	12.22	0.08
Second Evaluation Mean Score	75.11		

H03: The rate of falsified evaluation by students will not significantly reduce even when informed of possible rejection of appraisal data by the system

Table 3 (a)., Rating statuses of appraisals done

Variables	Uncompleted	Disqualified	Completed	Total
Rating Status	123(39.0%)	9(2.85%)	183(58.1%)	315

Table 3 (b): Differences in acceptance rate and disqualification rate of students' evaluation

Variables	Mean	Mean difference	p-value
Accepted evaluations	3.10	2.949	0.00
Rejected evaluations	0.15		

4.3 Discussion of Findings

Table 1 presented the personal details of the appraisers and the appraised lecturers briefly. The total number of students whose matriculation numbers were entered and were prospective appraisers of the SATP system was 73 students; 46 in ND1 and 27 in ND2. 6 lecturers were appraised during the study 5 males and 1 female. The study was conducted towards the end of second semester, as such both ND1 and ND2 students were well acquainted with the lecturers that were appraised. Out of 73 prospective students involved in the study, only 60 students actually used the system. 60 students were expected to conduct 360 first evaluation and 360 second evaluation, however, 315 (representing 87.5%) carried out first evaluation while 192 (representing 53.3% of those that carried out first evaluation) carried out second evaluation. These percentages are fair representation of the total number of students that were involved in the study.

The suitability and effectiveness of the SATP for conducting appraisal on teaching performance of lecturers as at when needed was presented in figures 3 (a) and 3 (b) as the screenshot visualization of various data generated as evaluation results on two of the lecturers appraised. It shows just the two lecturers were not appraised by the same number of students as lecturer "A" was appraised by 49 students while lecturer "B" was appraised by 52 students yet evaluation results was generated in the two instances. This is a step beyond the work of [19] whose method expected all students to evaluate each lecturer before decision is made using the ELECTRE method about the particular lecturer. Also, performances on each characteristic were also determined separately which would make it possible to support decision making about itemised individual characteristic. This support [12] that reported that suitable and effective SATP has to reflect on qualities associated with good teaching such as lecturers' knowledge, clarity, classroom management and course organization. More so, it was also shown that appraisal by some students on both lecturers were disqualified (rejected) by the system as they were suspected to be fraudulent by the base model of the SATP. As such this would reduce partiality and unfairness of students during assessment of the teaching performance of lecturers. Furthermore, Students' appraisal of lecturers' webpage presented in figure 2 shows that the web page was designed with the same specification in [18] which allows lecturers' performance evaluation on a 5-point rating scale such that it enable the students to perform ratings from the most ineffectiveness to the highly effectiveness of the lecturers' characteristics been measured. We would therefore reject $H_0$1 and conclude that the SATP system was suitable and effective for conducting appraisal on teaching performance of lecturers in tertiary institution.

In order to test hypothesis 2 that state that the system will not detect statistically detected falsified evaluation data on lecturers significantly. Table 2 (a) shows differences in first and second appraisal (evaluation) for accepted appraisal

data, it was found that the mean score recorded during second evaluation was slightly higher (μ=91.79) than that of first evaluation (μ=91.42), as such the difference recorded was found to be insignificant at 90% confidence interval ($\Delta\mu$ = 0.36, $p>0.10$). However, table 2 (b) which shows differences in first and second appraisal (evaluation) for rejected/disqualified appraisal data, and it was found that the mean score recorded during first evaluation was significantly higher (μ=87.33) than that of second evaluation (μ=75.11) and the difference was found to be significant at 90% confidence interval ($\Delta\mu$ = 12.22, $p<0.10$). As such, the statistical result reported in table 2 (a) and table 2 (b) supported the rationale behind acceptance and rejection of appraisal data reported by the SATP as rejected/disqualified appraisal data by SATP were also shown to possess larger disparity between first and second evaluation. This explained the reason why the SATP base model rejected the evaluations, as such we will reject $H_0 2$ and conclude that the system will detect falsified evaluation data that will be statistically detected using t-test statistics.

Tables 3 (a) and 3 (b) were presented in order to test the level of significance in reduction of falsified data when using SATP system provided the students are informed of possible rejection of falsified appraisal data. As presented in table 3 (a), during the period of pilot evaluation of the lecturers involved in the study by the students, 9 (2.85%) evaluations by students on various lecturers were rejected out of a total of 183 completed evaluations. Differences in acceptance rate and disqualification rate of students' evaluation in table 3 (b) shows that the accepted evaluations were significantly higher than the rejected evaluations ($\Delta\mu > 0$, $p<0.10$), this is believed is as a result of warning given to students of possible disqualification of falsified evaluation data. As such, we would reject $H_0 3$ and conclude that students would reduce falsification of evaluation on lecturer(s) if warned of possibility of rejection of evaluation data and given possibility of sanctioning when found guilty of falsification of evaluation on certain lecturer(s).

5. Conclusion and Recommendation

In this study, a prototype system for web based system for students' appraisal on teaching performance (SATP) was the developed and evaluated for suitability and effectiveness. It was found that the following assumptions that guided the study were valid:

i) SATP web based system developed was found suitable and effective for allowing students (the direct recipients of lecturer's productivity) to evaluate the performances of their lecturers
ii) SATP web based system developed allows for flexible retrieval of appraisal data anytime it is needed
iii) The acceptance and rejection of students' evaluations by the SATP system were found to be statistically valid as such the SATP web based system developed would detect significant number of falsified evaluation data by students.
iv) SATP web based system reduced falsification of judgments about a lecturer by sets of student(s) as such the system would reduce lecturers' coercion of students into giving falsified evaluation reports or intentional falsification of judgements about a lecturer by set of student(s) due to students' partiality and/or prejudice.
v) SATP web based system appraisal result were found to be valid

The implication of this study is that it presents a complementary system that allows management of tertiary institutions of learning retrieve reliable and effective performances evaluation reports about their teaching staffs as supplied by students – the direct recipients of the lecturers' outputs. It is therefore recommended that tertiary institutions in Nigeria adopts the web based Students Appraisal on Teaching Performance system based on the model developed in the study, and such institution that adopt the system are enjoined to intimate the students of possible sanction if certain number of falsified data discovered by the system are traced to them.

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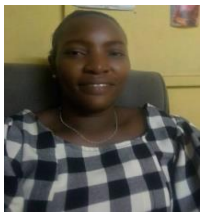

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