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# Lecturer-Aide – An E-Marking Tool to Aid Grading and Assessment of Students' Assignments

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## ABSTRACT

Lecturers spend an awful lot of time and effort to manually mark assignments. When marking assignments, lecturers go through a repetitive process of opening files, working through checklist, calculating grades, recording them, etc. It would be easier for lecturers to follow good-practice in assessment if some of this leg-work was done for them. This onerous task needs to be addressed so lecturers can quickly and easily mark assignments and provide more useful and qualitative feedback. With the advancement of technology, there have been attempts to overcome this burden through eMarking tools. With this in mind, this paper describes the design and implementation of an eMarking tool that will aid at automating the repetitive processes involved in marking so that the heavy load caused by these burdensome activities will be lifted off the shoulders of lecturers.

**Keywords:** Lecturer-Aide, E-Marking, Tool, Grading, Assessment, Students and Assignments

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## 1. INTRODUCTION

Assignment is one of the potent tools used in evaluating students' performance in the learning process. It provides advantages to all stakeholders in the learning process. It helps the student to gain in-depth knowledge and understanding on a topic. The lecturer uses the assignment to evaluate and assess the students' level of comprehension of the topic and consequently take measures to correct faults or magnify strengths of the student. There are many educational theories that show the importance of assignments and how valuable information can be gained from assessment results (Milne, Heinrich, & Morrison, 2008). Assignments are created by lecturers and given to students so that they can formulate their own thoughts and present their findings in prescribed formats e.g. charts, calculations, essays, computer programs etc. The lecturer then undergoes a marking process which produces the result or grade obtained by the student, and base on this, he/she provides a constructive feedback which is intended to help the student to learn and improve.

Therefore, the process of marking assignments and returning the grades/marks obtained, together with a feedback plays a crucial role in the assessment and learning processes (Heinrich, Milne, & Moore, 2009). However, the process of marking and assessing assignments especially formative type has the undesirous effect of increasing the workload of lecturers and tutors (Hepplestone, Holden, Irwin, Parkin, & Thorpe, 2011). Electronic marking (e-marking) is the evaluation and assessment of student assignments by a lecturer with the aid of a computer or mobile device. The lecturer provides marks and grades to the students' work using an e-marking tool which help in reducing some of the traditional processes done by hand. These tools usually come as standalone applications, plug-ins or add-ins that adds marking functionalities to generic applications or part of a Learning Management System (LMS) (TEDI, 2016). These tools also provide more opportunities and efficient means of providing feedback to students (O'Reilly, 2005).

Even though paper based assignments and exams are the most prevalent in developing countries (Brunner, 1993), electronically submitted assignment are gaining popularity and this makes the use of eMarking tools to mark them a welcome development. These assignments are submitted in different file formats such as documents, PDF, presentation slides, text files etc. This gradual acceptance of eAssignments is partly due to widespread usage of electronic devices e.g. computers and smartphones in learning, especially in tertiary institutions. Students prepare their assignments using these devices and submit them in the required format to a depository (mostly an email address) where the lecturer can access and assess them. Electronically submitted assignments also don't have distance as a barrier because students can submit their work from anywhere in as much as they have access to internet.

In this paper, we use open source software to develop an application that will liberate markers from some of the monotonous and laborious tasks of marking thereby creating an environment that facilitates quality feedback, enhancing student learning. The paper is structured as follows: Section II presents a review of previous work in this area, section III explains the design of the new tool, section IV is the evaluation, sectionV discusses the results obtained, and section VI concludes.

## 2. PREVIOUS WORK

(Heinrich, Milne, & Moore, 2009) and (Shortis & Burrows, 2009) have made extensive work on eMarking and its tools. They both categorised the tools based on the functionalities they provide. The former made four groupings, they are:

a. eMarking tools that provide facilities for elucidation and automated marking of restricted responses to questions like select-one, select-many and short free-form answers. These are the tools used in marking multiple-choice tests. Examples are Question mark Perception and abc.test
b. eMarking tools that automate the assessment of free-form writing.
c. eMarking tools that provide feedback for specific domains. Examples are BOSS and ASSYST for assessing engineering programming tasks.
d. Specialist eMarking tools for management and formative marking of assignments. They also offer features for providing quality feedback to students. Examples are Turnitin, Grademark, MarkTool etc.

Our tool falls under the last category.

The latter also made similar categorisation as follows:

a. Feedback-only tools
b. Marking-only tools for automated programming assessment
c. Test tools
d. Self and peer assessment
e. Plagiarism detection tools
f. Learning management system (LMS) components
g. Marking and feedback tools

The focus of this paper is on the last category most especially as it encompasses eMarking tools that are standalone desktop applications.

(Villalon, 2012) also designed and developed an eMarking tool that supports printing, digitalisation of paper based evaluations based on open source software. The tool was designed as a plugin for Moodle (LMS component).

Assignment assessment process can be divided into seven stages as pointed by (Milne, Heinrich, & Morrison, 2008). eMarking tools support these stages in different capacities depending on how it is designed and the functionalities it will support. The stages are:

1. Supporting students with assignments
2. Submission of assignments
3. Preparation of marking
4. Marking
5. Keeping records
6. Releasing results and providing feedback
7. Using assignment experience for future teaching

In the next section we will show what stages are supported and how they are implemented by our tool.

## 3. EMARKING TOOL

The tool is a standalone desktop (offline) application that aids in assignment assessment by providing features for opening file(s) associated with a task for a student's submission, presenting the marking scheme for that task, letting the lecturer allocate marks according to detailed assessment criteria, letting the lecturer provide specific feedback and/or select from a list based on the scores etc. The tool can best be used to mark essay-type assignments because it comprises of both formative (feedback) and summative (marks allocated to tasks) components.The GUI is designed using Swing with Multiple Document Interface (MDI).

### A. Preparation of Marking

The lecturer first locates student submission files and makes them ready for marking by unzipping them. It then allows the lecturer to give details of the assignment and to create a marking scheme for each task with its appropriate mark and feedback as shown in Figure 1. This marking criterion will be displayed when the lecturer starts marking.

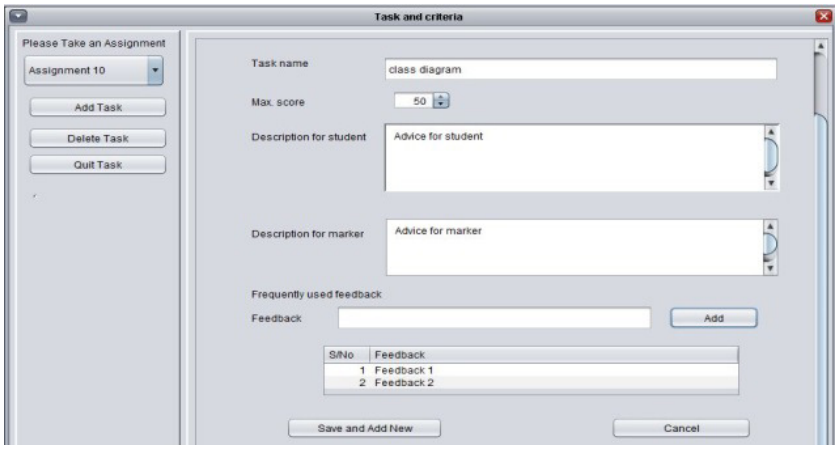


**Figure 1: Marking criterion**

### B. Marking

This is the assessment stage where the lecturer uses his/her professional judgement and expertise to allocate marks and feedback to students' works.

When the lecturer decides to start marking, the tool opens a task from a student submission and displays the marking criteria for the task, allowing the lecturer to allocate marks and feedback according to the criteria. The feedback can also be selected from a list created earlier by the lecturer as illustrated in Figure 2.

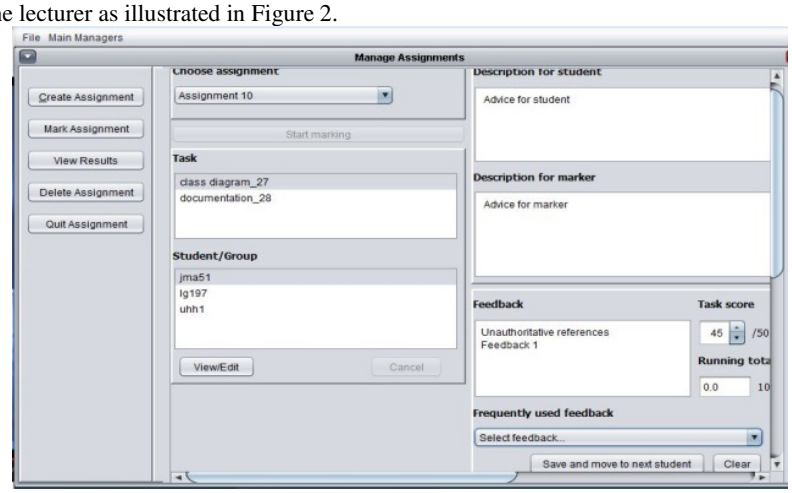


**Figure 2: Marking page**

### C. Keeping Records

The tool allows the lecturer to save assessment details (allocated in previous section) of a task associated with a student's work in a database (MySQL relational database was used). The process starts again for another student on the same task until all submissions associated with the task are marked, and then the marking process moves to the next task starting from the first student. The lecturer can also edit marks and feedback allocated to a task before and after saving.

### D. Releasing Results and Providing Feedback

The tool allows the lecturer to send marks and feedback of assignments to student(s) through their emails (created using JavaMail library and Java Activation Framework (JAF)). Marked assignment details can be exported either as spreadsheet, xml or pdf (created using the iText library) files.

### E. Using Assignment Experience for Future Teaching

The tool supports this stage of the assignment assessment process by providing statistical visualisation of students' performance on a task or the assignment as a whole (built using JFreeChart library). This will help the lecturer to reflect on the whole assessment process and make some adjustments and refinements for future purposes. An example is shown in Figure 3.

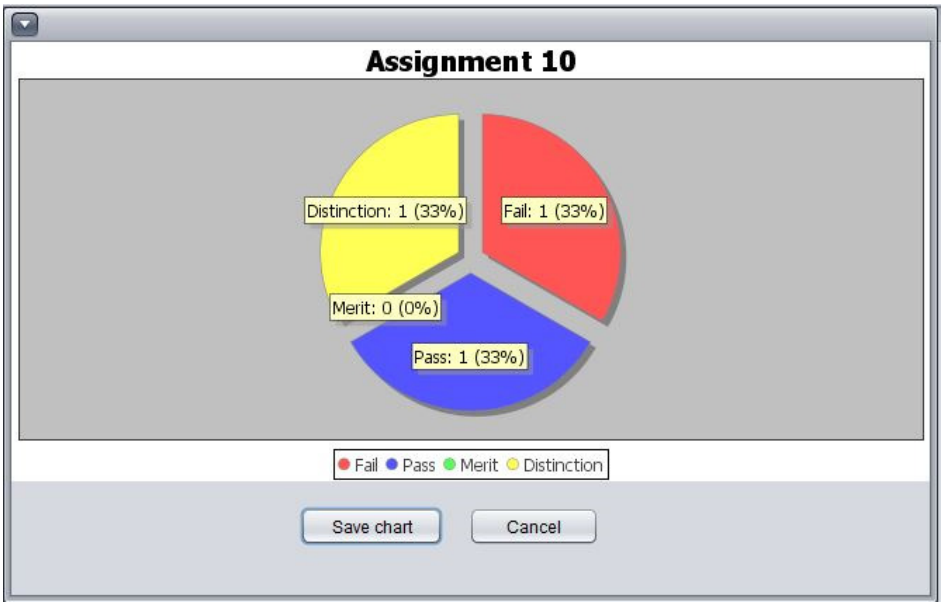


**Figure 3: Depiction of student performance**

## 4. EVALUATION

The system's usability was evaluated using the System Usability Scale (SUS) introduced by (Brooke, 1996). It is a ten-item scale that gives a generic assessment of a system's usability from a user perspective. Each item is a statement that a user responds to immediately after using the system. These responses are on a 5 point scale ranging from "strongly agree" (4) to "strongly disagree" (0). After the user has finished responding to the items, a single score representing the usability of the system is calculated from the points awarded. SUS score has a range of 0 – 100. It is the overall general appropriateness to purpose for an object covering effectiveness (how effective can tasks be accomplished using the system and the correctness of the finished product), efficiency (resource consumption) and satisfaction (user's response) (ISO9241-11, 1998). For this, 10 lecturers were used as respondents.

The graphical user interface (GUI) was tested using the Fixtures for Easy Software Testing (FEST) swing testing module. Lastly, performance retardation was evaluated on a class of 31 students each with an assignment that has two tasks. The application does pay regular visits to the database through the execution of SQL queries and this tends to affect system performance.

## 5. RESULTS

The mean score from the 10 respondents of the SUS is 71.7 out of 100 as shown in Table 1 and if compared with the School Grading Scale proposed by (Bangor, Kortum, & Miller, 2009) shown in Figure 4, the tool will have an adjective rating of GOOD or C grade. This score is encouraging because it shows that the tool can be used to accomplish the task of marking with relative ease and efficiency.

**Table 1: SUS scores from respondents**

| Respondent | SUS score |
|---|---|
| Lecturer 1 | 69 |
| Lecturer 2 | 73 |
| Lecturer 3 | 70 |
| Lecturer 4 | 72 |
| Lecturer 5 | 70 |
| Lecturer 6 | 86 |
| Lecturer 7 | 77 |
| Lecturer 8 | 64 |
| Lecturer 9 | 71 |
| Lecturer 10 | 65 |

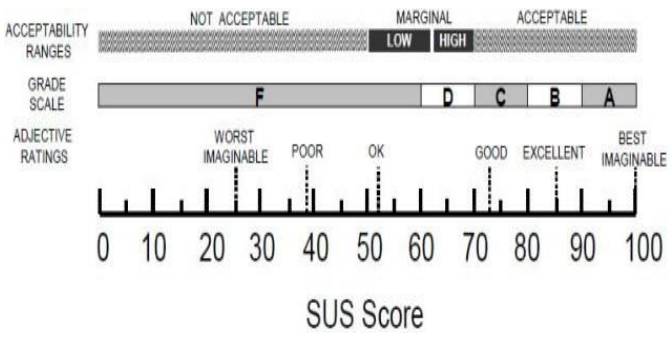


**Figure 4: A comparison of the adjective ratings, acceptabilioty scores, and school grading scales, in relation to the average SUS score**

The FEST tests for the GUI recorded impressive results with almost all components (button, radio buttons, JSpinners, JLists etc.) of the interface been tested. Figure 5 shows the outcome of the Login page test.


**Figure 5: FEST test result for Login page**

The tool performed very well when used to mark the assignment of a class of 31 students. Because this number is small, we envisage performance retardation for a larger class and therefore we tried to tackle the problem by using prepared statements instead of Statements and Callable Statements. Prepared statements are faster to execute because they get precompiled before accessing the database and also offer the added advantage of preventing SQL injection attacks.

## 6. DISCUSSION AND FUTURE WORK

Of all the challenges faced by lecturers in teaching, marking of and providing feedback to students' assignments is the most aching and painful. This is because when lecturers mark assignments, they need to arrive at an informed and considered conclusion on the students' work while they go through a repetitive process of opening files, working through checklist, calculating grades, recording them, writing feedbacks etc. These tasks are monotonous and time consuming. eMarking tools help in automating some of these laborious tasks and thus, making marking convenient and expedient. They help in establishing an orthodox way of marking thereby enabling lecturers to spend more time and resources on the judgment and evaluation of students' work. This paper has presented an eMarking tool that helps lecturers in accomplishing this task and the results obtained have shown the design and implementation of such a tool is feasible and viable. The tool has also been evaluated to be easy to use with a nice looking interface and good performance.

In the future, we envisage incorporating the first two stages of the assignment assessment process i.e. *supporting students with assignments* and *submission of assignments*. As marking guides were used in the tool, future works can try using ***rubrics*** instead or a combination of the two. Incorporation of a second marker's assessment can also be added to future versions of the tool.

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