

# e-GRADO: DEVELOPMENT OF A STANDARDIZED GRADING PORTAL FOR DEPARTMENTAL COURSES IN COLLEGE OF ENGINEERING

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**ABSTRACT.** This study focuses on the development of the e-GRADO portal, an innovative grading system designed to streamline grade processing and standardize assessment activities in the College of Engineering. The existing educational grading system faced challenges including time-consuming manual grade recording and lack of uniformity in assessment activities for similar courses. Leveraging PHP, MySQL, and WAMP Server, e-GRADO efficiently integrates results from Scantron OpScan 4ES, a machine checker, thus automating the grading process. It aligns course assessments with the Outcome-Based Education (OBE) syllabus standards and enables effective communication of results to students via email. The user experience and functionality of the platform were evaluated by the faculty, yielding a high overall approval rating. The system enhances grading accuracy, promotes standardization of assessments, and provides transparency for students. However, future improvements, such as direct interface with Scantron OpScan 3ES and integration with the university's database, are recommended to optimize the e-GRADO portal's potential.

Keywords: Machine Checker Integration, Automated Grading System, Outcome-Based Education, Assessment Standardization.

## I. INTRODUCTION

Grading, as elucidated by Brookhart et al. (2016), is a crucial process that evaluates and communicates students' learning progress, motivates their engagement, and organizes learning experiences. However, achieving these goals requires an efficient method of grading, particularly in higher education.

In the realm of engineering education, there exists a recognized challenge of maintaining student engagement due to the highly theoretical nature of the course materials and the high volume of contact hours. Felder and Brent (2005) suggested that engagement could drop off sharply after only 15-20 minutes, emphasizing the need for effective teaching methodologies.

Multiple-Choice Questions (MCQs) are a widely adopted assessment method in engineering education, praised for their time efficiency, high reliability, and compatibility with technological platforms. Even though MCQs are recognized for their reliability in professional qualification exams globally, there remains a gap in fully integrating this grading method with the principles of outcome-based education (OBE) and the grading systems of institutions.

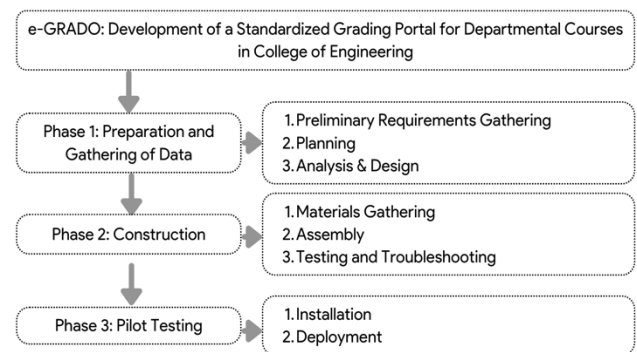
Several universities in Davao City have implemented MCQs and introduced automated grading machines. However, the lack of integration between these technologies and a comprehensive Grading Portal leaf much to be desired in terms of efficiency and alignment with the OBE syllabus.

This study addresses these challenges by proposing eGRADO: A Standardized Grading Portal for Departmental Courses in the College of Engineering. This portal aims to streamline the grading process, automate the collection and recording of results, synchronize it with OBE methodologies, and prepare students more effectively for their licensure examinations.

## II. METHODOLOGY

### Research Design

The research design used to achieve the objective of the project that will accomplish the expected result is based on System Life Cycle (SDLC). Generally, it has three (3) primary phases, which is Preparation and Gathering of Data, Construction, and Pilot testing as shown in Figure 1.



**Figure 1. Design, Construction, and Pilot Testing Process Procedures**

### Phase I: Design for e-GRADO

The proponent designed a Grading Portal that will integrate results from the machine checker for efficient recording and will help professors teaching the basic subject courses to align and synchronize their learning evidence and assessment activities based on the standard syllabus.

#### A. Preliminary Requirements Gathering

The research team conducted in-depth interviews with key stakeholders: the registrar of the University of Southeastern Philippines, selected faculty, and the dean of the college. The purpose of these interviews was to gain crucial insights needed for the development of the system. To supplement these interviews and provide quantitative data, a pre-survey was administered to the stakeholders. This instrument is detailed in Appendix B.

The gathered baseline data reflected high ratings across all evaluated areas: Perceived Usefulness (4.98/5), Perceived Ease of Use (5.00/5), Navigation of the Portal (5.00/5), Design of the Website (4.8/5), Content of the Portal (4.90/5), and Security of the Portal (5.00/5). These ratings underscored the perceived value and relevance of the proposed system.

During this stage, the researchers conducted a comprehensive plan encompassing project resources, requirements, and scheduling. An extensive literature review was carried out, collecting materials from scholarly journals, textbooks, and research papers available in libraries and online databases.

The focus of this period was to gain a deep understanding of the course syllabus, specifically the learning evidence and assessment activities. The team aimed to ascertain how the Grading Portal could be designed and standardized to accommodate these elements effectively. Particular attention was given to identifying existing gaps that could be leading to grading inconsistencies among professors teaching the same fundamental subject courses.

**B. Planning**

The proponent formulated plans on the set-up and technical specifications on which the system will operate. The descriptive method of research was used for this study. Considered the grading process and standards through a conducted interview to seek permission for the implementation of the web-based Grading Portal. The proponents considered the availability and compatibility of the components and tools about hardware and software to be used and information needed through feedback by teachers and students to come up with the realization of the design.

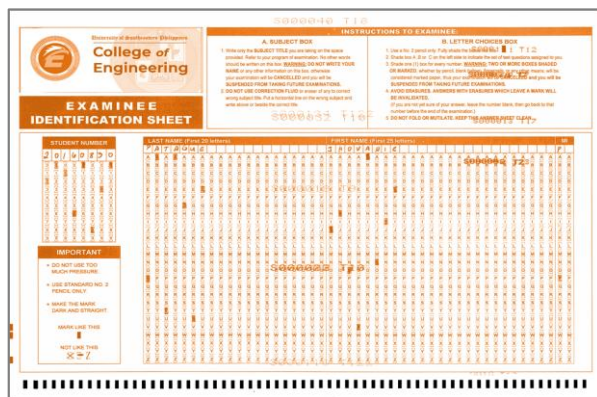
**C. Analysis and Design**

Three general steps can be followed to select the control system appropriately:

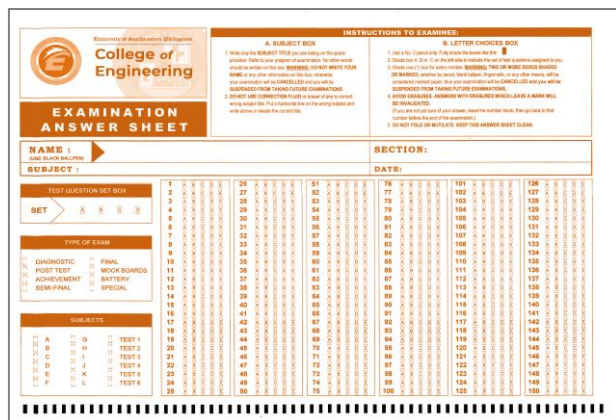
**Step #1:** Identify measurable parameters important to production.

The proponent considered the importance of correctly identifying the parameters to be extracted from the machine checker to the Grading Portal. The answer sheet is double sided with relevant information as shown in Figure 2 such as the student’s information including his/her Student Number, Last Name, First Name, and Middle Initials.

The other side of the answer sheet as shown in Figure 3 contains relevant information of such as test question test set, type of exam, subject and most especially the shaded answers. Once the double-sided answer sheet is loaded, information is extracted in excel file. The generated excel file will automatically be imported to the system for recording the results of the primary examination. It should be taken note that the user of the machine checker is to automate the recording of the primary departmental examination of the college.



**Figure 2 Front Side of Answer Sheet: Student's Information**

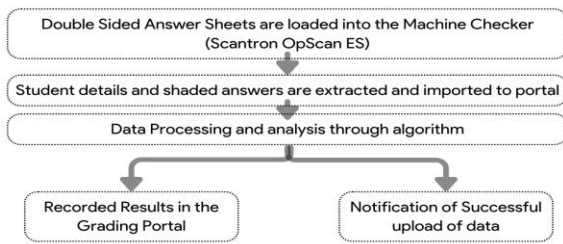


**Figure 3 Back Side of Answer Sheet: Student's Information**

**Step #3:** Identify the software and the hardware to be used.

Since the hardware involved in the project is the Machine Checker (Scantron OpScan ES) and the server, careful consideration of software tool for programming/developing the Grading Portal and might as well the framework used should be done. The project considered Php with Javascript and used Laravel for its framework.

After all the necessary data have been gathered and analyzing the steps to be followed in designing the system, the proponent performed thorough analysis to design the system for a Grading Portal that will integrate results from the machine checker for efficient recording and will help professors teaching the fundamental subject courses align and synchronize their learning evidence and assessment activities based on the standard syllabus. This is shown in Figure 4.



**Figure 4 System for e-GRADO**

*Phase II: Construction of the e-GRADO*

*A. Gathering of Materials*

Following the design process, the proponent gathered all the required materials for the prototype system. After the outline defense, the proponent has started to gather data from different sources to formulate the scope, design, processes and software and hardware requirements needed to make the web application for the study and it is done through discussions with the stakeholders and the presence and approval of the adviser. The required Hardware components and the required Software/Programming languages/Framework are shown in Table 1 and 2 respectively.

**Table 1: Hardware Materials Description**

No.	Hardware	Description
1	Server	Is a device that provides functionality for the Grading Portal and houses the database of the grades
2	Machine Checker (Scantron Op ES)	Automated machine for checking major examinations based on

**Table 2: Software (SW) Requirements Description**

No.	SW	Description
1	MySQL	Used to generate the database for class and student's information and grades storing and retrieval.
2	JavaScript	Used as a programming language in developing the website as well as the system's local server since laravel framework typically runs JavaScript on the server-side.
3	PHP	Used as the website' server-side programming language and is responsible for the retrieval of information coming from the MySQL database since PHP can connect and manipulate databases.
4	Laravel Framework	Used to create full-featured web-application

*B. Assembly*

Once the requirements are known, the system development process begins on both web application and Hardware Integration. The Machine Checker (Scantron Op ES) will be used to gather both student's information and answers from the significant examination. The Server will be used to host information gathered and to be processed through the database. The following algorithm is used:

Algorithm 1: Machine Checker Processing
Step 1: Capture scan lines while identifying the shaded answers.
Step 2: Conversion from an analog signal to digital signal
Step 3: Quantizing the converted digital signal.
Step 4: Input quantize signal to the MCU.
Step 5: Go back to Step 1
Algorithm 2: Grade System Processing
Step 1: Generate extracted results in an Excel file.
Step 2: Upload Major Examination results from the excel file to the system.
Step 3: downloading results to the respective student's information such as students ID number.
Step 4: Go back to Step 1

*C. Testing, Troubleshooting, and documentation*

The researchers do test runs and demonstrations to see that the prototype has accomplished the objectives. With an accomplished system, e-GRADO will undergo a series of tests and evaluations from the selected department that teaches the same faculty load of one fundamental course such as calculus to assess the accuracy and reliability of the results. Moreover, troubleshooting will be made to assess its functionality as well. These will further improve the whole system and ensures the reliability of the results.

*Phase III: Pilot Testing*

*A. Installation*

Following the design process, the proponent gathered all the required materials for the prototype system. After the outline defense, the proponent has started to gather data from different sources to formulate the scope, design, processes.

*B. Deployment*

The proponent must present e-grado by giving a demonstration of the functionality to the instructors of the College of Engineering. The proponents must also explain the working principle and the effectiveness of the device to the participants.

*C. Participants*

The The participants of the study are the (1) Admin, (2) Instructors/Professors, (3) Dean and (30) Students.

*D. Research Locale*

The study is conducted at the College of Engineering, University of Southeastern Philippines, Obrero, Davao City where target beneficiaries and project implementation are located.

E. Period of the Study

The target length of this study will cover the first semester and expected to end by June of the year 2019.

III. RESULTS AND DISCUSSION

The e-GRADO was realized with the use of PHP MySQL and the WAMP Sefarms. The main purpose of this portal is to create grading portal that will integrate results from the machine checker for efficient recording and will help professors teaching the same fundamental subject courses align and synchronize their learning evidences and assessment activities based on the standard syllabus.

To integrate results of Departmental Examination based on MCQs type from the Machine Checker (Scantron OpScan 4ES) to the Grading portal.

Before grades will be uploaded from the machine checker, the need of enrolling students in the portal to their class and syllabus should be done by the designated admin.

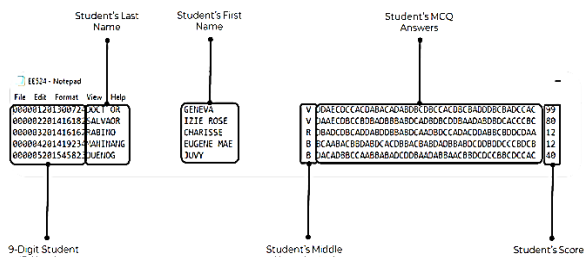


Figure 6. DAT File

Student ID	Student Name	AA1 Quiz 25%	AA2 Assignment 25%	LO1 Project Design 25%	LO2 Examination 25%
201300720	kent ivan abor mazo	0	0	0	50
201414879	miklo escosa pariz	0	0	0	30
201423455	japhet molunas posheco	0	0	0	20
201449102	ivann magno olivsonatin	0	0	0	27

Figure 7. Grade/Scores Uploading

To grade, record, and compute results in grading portal aligned on defined standards of the course subject.

To grade and compute results, the need to add a course subject based on OBE syllabus should be done. As shown in Figure 8, the assigned administrator will only be allowed to create the subject course together with other information such as Subject Code, Title, Prerequisite, Subject description, and Credit.

ID	Code	Title	Prerequisite	Credit
1	IT 420	IT Capstone Project 2	None	3 units
2	IT 410	IT Practicum	None	3 units
3	IT 440	IT Practicum 2	IT 410, IT Practicum	3 units
7	IT 311	IT PE3	None	3 units
8	IT 110	IT Disasters	IT 111, IT PE1	3 units

Figure 8. View and Add Courses

Now once the Subject Courses are added into the e-GRADO, the next thing to do is to create a grading portal for the corresponding subject course based on the syllabus. As shown in Figure 9, it provides an easy environment for creating grading portal.

The screenshot shows a form for adding a course with the following fields: Course Title, Course Code, Credit, Prerequisite, and Course Description. The form is part of a larger interface with a sidebar menu.

Figure 9. View Grading portal & Add Grading portal.

Figure 5. Enrolling Students to e-GRADO portal

As shown in Figure 5, the e-GRADO portal offers two option: (1) Manual Entry of each student information which includes their Name, ID Number, Year Level, Contact Number, Email Address, and their Class or (2) Batch upload of the student's information just mentioned to their corresponding class. Now once the students are enrolled in the e-GRADO portal, the grades input from Machine checker is ready to upload.

Figure 6. DAT File

The primary intention of the proponent is to get the data from the double-sided answer sheet through the Machine checker to the e-GRADO system but due to the d limited capability of the machine checker to transport the data to any third-party software which was discovered during the preliminary gathering of data from the Scantron representatives, thus the proponent decided to utilize the output file of the machine checker in .xlsx, .dat, .sik. and .xml. Therefore, manual uploading of results should be done by the designated admin in the server. As shown in Figure 6, the DAT file presents data: 9-Digit Student ID Number, Last Name, First Name, Middle Initial, MCQ Answers, and MCQ Test Score. Once DAT file is generated, an upload button from e-GRADO portal is provided for batch upload of grade results from the DAT file. After the upload, the results will automatically be locked-in and reflect to the LO: Major Exam Column as shown in Figure 7.

To provide students with a copy of their results at the end of exams via E-mail notification.

During the time of final grade submission, students will be informed of their final grade and its summary. As shown in Figure 10 - 11 the professor/instructor will be provided with the option to send mail results.

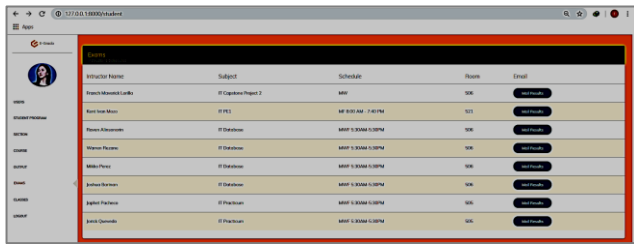


Figure 10. Option to send the results in email.

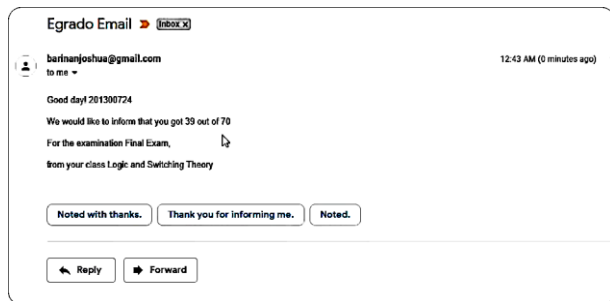


Figure 11. Sample Email Received

Enable admin to view, edit, approve final submission, and print the Grading Sheet to review and confirm the submitted grade of concerned faculty.

The last objective is for the admin can view, edit, and approve grades submitted by the concerned faculty as shown in Figure 12. This account could assign another account say the dean for accessing other roles such as viewing of the grades to check if the submitted grades are same as the one reflected in the University's Grade submission portal. With e-GRADO platform, checking for class records and grading portal based on standard syllabus is easy to monitor. To mention utilization of machine checker for checking the answer sheet and the fact that student is practiced to shade or being simulated for board exam are all possible with the portal proposed.

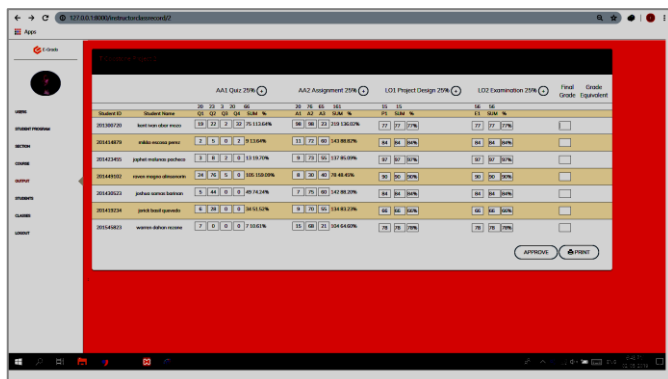


Figure 12. View, Edit, approve final submission, and print grading sheet.

### Post survey during Faculty Testing Results

After coding, design work, and error checking, the e-GRADO portal was tested for its functionality, design, and applicability. Faculty members, including heads of different engineering disciplines, subject committee heads, and the dean, were invited to evaluate the system. Davis's 1989 usability and user experience questionnaires were used for evaluation. Here are the summarized results:

- (1) Perceived Usefulness: e-GRADO was rated 4.63 out of 5, indicating it's 'very good' in helping to record grades quickly, evaluating student work, and communicating course adjustments to students.
- (2) Perceived Ease of Use: e-GRADO received a 'very good' rating of 4.73, highlighting its user-friendly interface, accurate grade computation, and convenient communication channel for feedback.
- (3) Design: The portal's aesthetically pleasing and user-friendly design received a 'very good' score of 4.58.
- (4) Content: e-GRADO's informative and easily understood content was also rated as 'very good' with a score of 4.53.
- (5) Security: The security features of the portal received a 'very good' rating of 4.59, including edit permissions and user registration.

There were also comments from users like Engr. Ramos, who noted the importance of real-world testing, and Engr. Torrico, who commented on the need to monitor the number of Learning Outcomes (LOs) and Assessment Activities (AAs) for each faculty member. Overall, the e-GRADO portal received an average score of 4.59, meeting stakeholders' requirements. The comments and suggestions will be taken into consideration for future system improvements.

## IV. CONCLUSION

The e-GRADO platform, a grading portal, holds vast potential for the College of Engineering, as it allows professors to standardize their grading systems based on the OBE syllabus. It integrates with machine checkers to automatically populate grades and locks these results for transparency. Key findings are:

- (1) Machine checker grades are successfully uploaded to the e-GRADO platform via excel files, reducing the risk of manual errors.
- (2) Professors and deans can manage their courses effectively, aligning grading standards and automating recording of results. Deans also have access to faculty's class records for administrative clearance.
- (3) e-GRADO allows grades to be emailed to students, providing prompt feedback on their performance.
- (4) The system includes an administrative function to edit grades upon faculty request.

## V. RECOMMENDATIONS

While e-GRADO is effective, several improvements can further enhance its potential:

- (1) Allow direct interface from the Scantron OPScan 3ES to the PHP database to eliminate manual upload of the DAT file generated results to the e-GRADO portal and

remove any changes of altering results of the exported file by considering open-source machine checker or the with the LAN feature of Scantron OPScan.

- (2) Connect e-GRADO portal automatically to the University's database duly approved by the top management and registrar's concern.
- (3) Host e-GRADO to University's server for remote access of the concerned users specifically faculty who can still encode grades outside the University.
- (4) Apply UX/UI to the e-GRADO portal to enhance user experience as they interact with the app. This is needed to create an easy-to-navigate software for users' convenience.
- (5) Expand its application to other courses in the University with Board exam to simulate examination environment which will help increase confidence and chances of passing the exam.

## VI. ACKNOWLEDGEMENT

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