

Contemporary and Technology Based Assessment and Feedback for Student Enhanced Learning: A Case Study of Mechanical Engineering Department at Middle East College

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Abstract

Assessment is an important part to identify the strengths and weaknesses of student learning. Various approaches for module delivery have been implemented, emphasizing the value of student participation and their role in the educational process. This provides an excellent strategy to evaluate students over time and improve their performances. In this study, performance-based assessment as a modern form of assessment presented and discussed. Students' work was gathered in portfolios (Microsoft OneNote) so that their performance, effort, and progress could be monitored and tracked along with the task requirements. Module delivery strategy as a case study is also presented accompanied with the assessment and feedback methods.

Additionally, the significance of incorporating students in the feedback process, increasing their capacity to appraise the quality of their own and their peers' work, and fostering their capacity to conduct self-evaluations and develop into independent learners were all covered in detail. The study shows that digitalize written comments to facilitate the feedback process particularly in case of high number of students, with specific and clear criteria will help to give the right feedback at the right time. Furthermore, conducting discussion sessions to get peer feedback and reflection indicated that the understanding of students on the given feedback was improved.

Keywords: *Assessment, Performance-based feedback, Digitalized written comments. Enhanced learning*

1. Introduction

Assessment is an important part to identify the strengths and weaknesses of student learning. From engineering aspects, assessment evaluates engineering students' performances by awarding

them score/marks about the quality and extent of their achievements and providing qualitative feedback that leads to improve their learning in the process of developing their professional field (Subheesh & Sethy, 2018). The assessment does not only judge the performance of students, but it also judges the effectiveness of teaching methods used by teachers. based on the response of the students, teachers then can assess what is required for the students to perform better. Furthermore, this feedback could help teachers improve their teaching and learning approach. Hence, assessment evaluates, the achievement of learning of the module learning outcome, whether the students have acquired the necessary information to achieve the module learning outcomes, the students' performance and differentiate between the good and bad performance, and the correctness of the module delivery approach.

Traditional assessment methods would not be able to accurately assess specific skills, such as analytical skills, problem-solving skills, communication, team-working skills, etc., while technological assessment and feedback techniques can continuously monitor and enhance students' progress (Subheesh & Sethy, 2018).

From quality of teaching and learning perspective the right feedback in timely manner and the implementation of effective assessment practices monitors and improves students' performances. Furthermore, through implementing an effective assessment practice and timely feedback, the learning objectives can be measured precisely.

Providing quality information to students is very important to ensuring student learning (Al-Bashir, Kabir, and Rahman, 2016). Constructive feedback, generic feedback, peer feedback, students' feedback, and self-feedback are modes of various feedback types (Adarkwah, 2020). Colbran et al., 2016 defines feedback as the "cornerstone of all learning." Bergil

and Atlib, 2012 describe that the educational achievement and learning can be enhanced by the right feedback given at the right time. In general, direct, indirect, immediate, corrective, explanatory, planned, unplanned, written, and oral methods can be utilized to provide formative and summative feedback. To evaluate the effectiveness of the feedback, many techniques such as classroom tests, document analysis, questionnaires, interviews, and discussions might be used.

Peer assessment, in addition to the teacher's input, has been found to assist students improve communication, build stronger interpersonal relationships, and keep track of their own and others' progress. Peer assessment feedback is an important strategy for getting students involved in their own learning and self-evaluations.

In peer feedback, learners collaborate (team building) and provide feedback on each other's work with the aim of enhancing learning (Banister 2020). Writing comments on peers' work improves students' understanding of feedback, allowing them to evaluate their own work and guide their own development (UCL assessment guide, 2017).

Giving feedback by staff members may become tiresome and time-consuming, especially when it's done in large classes where it might be challenging to provide timely input. Lack of an explicit assessment criteria can also impede peers from providing quality feedback.

On the other hand, feedback may become ineffective and result in feedback dissatisfaction unless relevant and consistent feedback is given. In large class size it would be difficult to provide individual feedback and could be less relevant to help students to apply to the next assignment. Ineffective feedback might also result misunderstanding, assessment overloading, negative and unexpected learning.

Better learning environments could be initiated between the students and the lecturer themselves during the feedback process and focusing on positive feedback to motivate the students to improve the part of their coursework that require student's attention.

The design, development, and use of evaluation standards require coherent study and conversation.

Further research investigations are required, according to (Lima et al., 2012), in order to clearly identify the perception and attitude of engineering faculty members toward evaluation techniques. More studies are required, according to McLean (2018), to determine how feedback affects evaluation practices. In this research paper, various of module delivery and assessment feedbacks were presented and discussed that enhanced the students' learning performance.

2. Module delivery method

The success of any strategy in delivering module is highly dependent on those who are delivering and receiving the training and the assessment (Misko, 2000).

Different approaches for module delivery have been adopted, emphasizing the value of student participation and their part in the educational process. These methods offer an efficient approach to be used in student assessment over time and improve students' performance (Figure 1). As part of the student-led teaching methodology, the lectures were planned to be delivered in collaboration with the selected company for the Mechanical Product Innovation and Management module. Students prepare a PPT and deliver it as a mini lecture on various topics to their peers, the module teacher, and industry experts (the topics were distributed for them through MEC Learn as a pre-work). Based on the mini lecture presented, students have received feedbacks from the industry expert, their peers and module teacher. From the feedbacks students would learn on the basic principles and industry experience which were forwarded from all participants. This is aligned with the attainment of employability by enhancing the students' domain knowledge, communication skills and presentation skill.

As shown in (Figure 1), students got the required knowledge about specific topics to be ready for the selected company visits. During the company visit students need to understand the process and are required to collect data from the selected company using the knowledge they obtained from the mini lectures beforehand. During the presentation and the company visit, students get feedback from the industry expert, their peers, and the module teacher in direct mode and via digital mode using web-based

survey tools. furthermore, product specification design requirements will be identified and then converted into drawings (Flowcharts, and block

of assessment such as written examination, multiple-choice tests, true/false tests, short answers, and essays which are still useful and utilized in many

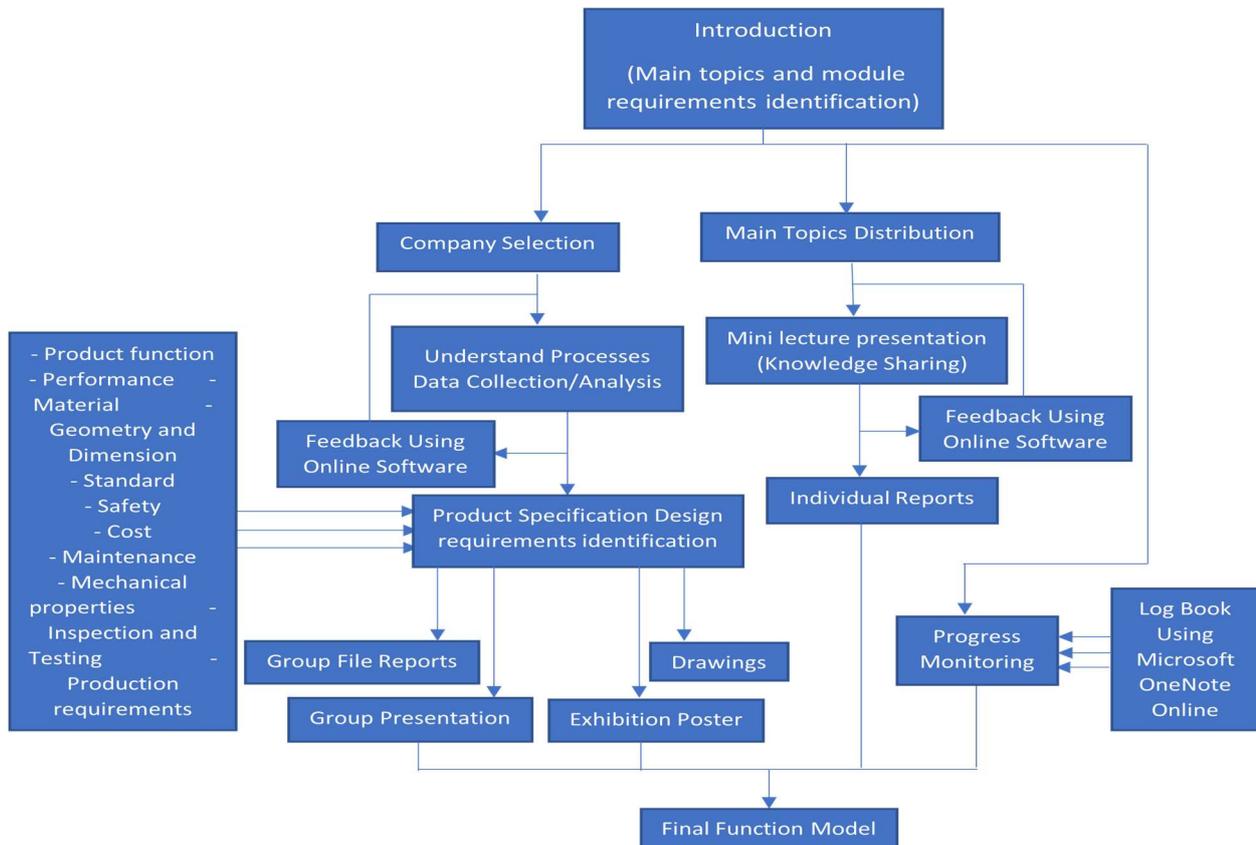


diagram) to create the company’s final function model. At the end, they will have obtained a group file report, group presentation, and an exhibition poster which will all be submitted for evaluation. In this regard, completion of a structured problem specification may be found in the processes, establishing proper limits and criteria, developing concepts that might work, and then refining concepts based on criteria ranking to concentrate on the most probable answer.

different subjects. On the other hand, analytical skills, problem-solving skills, communication skills, team working skills, etc., that would not be assessed by traditional assessment practices will required to be assessed using other technics. For instance, assessments such as 1. Project – based assessment (Individually and/or group project (Projects can take many different forms, such as research proposal, the creation of plans, and PPT presentations, to demonstrate what students know about a particular topic.). (It is a type of Problem-based learning). Then, present conclusions they reach in a variety of ways, including written reports, role-

3. Assessment Feedback Design and Evaluation

Providing quality information to students is very crucial to make sure students’ learning (Al-Bashir, 2016). In general, there are different traditional forms

playing, and PPT presentations; 2. Computer simulation; 3. Portfolio assessments; 4. Lab test as a

Hands on of experiments; 5. Field visit; 6. Exhibits (Poster, presentation) etc.

All the above-mentioned forms of assessment could be considered as Performance – Based Assessment. This type of assessment assesses higher-order thinking skills where students can demonstrate what they learned and focus on the growth and the performance of the student. Since Performance – Based Assessment is developed in context and over time, the teacher has a chance to measure the strengths and weaknesses of the student in a variety of areas and situations (Dikli, 2003). In this way, by using higher order thinking skills so that students can solve real-life related problems.

3.1 Technology Based Assessment and Feedback Case Studies:

At Middle East College (MEC), the assessment design came to cover the skills required by industry, starting from writing sound technical reports, working in team environment, communicate well, innovate, and keep improving their knowledge as a part of lifelong learning.

3.1.1 Continuous assessments and feedback

For the Mechanical Product Innovation module, where three assignments were created and carried out over the course of the semester in alignment with MLOs, continuous assessments and feedback were used. Market positioning, an introduction design project, and an advanced design project are all covered in the assignments. In this regard, students do market research and technological development for the chosen product before making improvements to it in order to address any issues and meet the needs of the target market. The students' ability to solve problems that may arise in the workplace as well as skills like lifelong learning and research abilities are developed as a result. In this approach, students' progress and performance are guaranteed, making the feedback more useful and certain to be used moving forward.

For the introductory and advanced projects, the students work in various groups, which enhances the chance that they may meet people from diverse backgrounds and interests. Their social connections and skills will improve as a result. Increase the

likelihood that students will collaborate with others, which will aid in determining their own strengths and weaknesses.

3.1.2 Performance-based assessments

Performance-based assessments as a modern method of evaluation were adopted and used for the Product Innovation and Management module. In these assessments, students gave mini lectures on the topics they had chosen in the companies, explained how those companies operated, and collected and analyzed the necessary data to determine the benefits and drawbacks of those operations and to recommend necessary solutions in case of issues or a lack of technology. Students' work was compiled in a digital portfolio (Microsoft OneNote) to demonstrate and track their effort, performance, and progress in addition to meeting the task requirements. To succeed in the engineering profession, skills including communication skills, innovative thinking, lifelong learning, and teamwork skills all improve.

3.1.3 Digitalized written comments

The use of technology in student assessment can bring the motivational effect of getting immediate feedback, which would not have been possible otherwise (Subheesh & Sethy, 2018). In this regard, digitalized written comments were implemented to simplify the feedback process, especially for those modules that require numerical solutions and simulation software, with precise and definite criteria that would help deliver the right feedback at the right time. Cross-tabulation rubrics are effective for this level of feedback, but they are insufficient to provide each student with precise and detailed feedback. Advanced Excel sheets were used to provide detailed feedback remarks based on the marks given for each answer to fully satisfy the students. Teacher only needs to evaluate the student answer by giving mark between (0-10), then the comments will be generated and identified automatically for that student. Those comments were prepared by data collected from different semesters and selected with type of fuzzy logic using Microsoft Excel.

3.1.4 Direct feedback and marking with student's presence

The use of direct feedback and marking while students were present was put into practice. This helps to start a discussion session where peers can offer comments, reflect, and help in understanding the feedback before returning with the proper and good progress and accomplishment. Additionally, this promotes transparency, total student satisfaction, and the development of self-assessment, all of which contribute to the effectiveness of feedback. Along with the significance of integrating students in the feedback procedure, assisting them in learning how to assess the quality of their own work as well as that of their peers, and assisting them in learning how to assess themselves and develop into independent learners. So, improving self-assessment can enhance the effectiveness of feedback.

For some numerical modules, mock test as a pre-assessment practices and discussion about the missed points from previous work with associated criteria will ensure the effectiveness of the feedback and leads to effective learning process.

Mock test for the numerical modules was very helpful and represent a type of preparation and review for best performance. At the end as the measurement of success, and to see how much the student learned the summative assessment in terms of end semester exam (ESE) and close book test (CBT) were conducted and students perform better.

3.1.5 Kolb's experimental learning cycle

(Murray, 2007) was implemented for the structural modules in an online classroom to improve instruction and student retention. This cycle consists of four stages: direct experience, reflective observation, conceptualization, and active experimentation.

The flipped classroom model is central to the teaching philosophy at Middle East College. Using Screen-o-Matic, more than 30 videos to use in flipped classroom environment. Students could watch the final products thanks to embedded YouTube links.

Issue 1: Some students did view the video, but after a few weeks of practice, realized that couldn't monitor each student's progress and ensure they understood the material.

Strategy 1: Using the Edpuzzle and H5P package, were able to solve the aforementioned problem by creating interactive videos. Students' timely, regular, and productive engagement in pre-class activities, which are meant to prepare students for effective participation in face-to-face sessions, is crucial to the success of the flipped classroom concept (Pardo et. al,2019). The use of quizzes embedded in interactive videos was a pre-class activity. Post-lesson assignments typically included a quiz, some homework, or a presentation. The student's formative assessments were assessed by using Edpuzzle and self-detection of the correct answers in H5P software.

Issue 2: Making students understand structural modules is difficult if students don't visualize the structures and requirements for stability of a structure is not understood (Aparicio and Ruiz-Teran 2007). The same were faced by the faculty teaching structural modules.

Strategy 2: To combat this issue, utilized Google Sketchup, a 3D visualization programme, to have students imagine how the various parts would fit together. SketchUp is a popular 3D modelling programme in the fields of architecture, interior design, landscape design, civil engineering, and mechanical engineering. SketchUp is a web-based tool having both a free and commercial edition accessible (Chopra 2012). Google SketchUp, a web-based application was used to help students visualize the structures and their analysis, was important in this process.

Further, for active participation of all students, group presentations on case studies on sustainable principles, health and safety standards, buildability attributes and students assessing and sharing each other's knowledge was a key element. The oral feedback was provided to all the groups which were effective in terms of sharing of the knowledge and feedforward in terms of presentation skills as well.

4. Results and discussion

In different modules various types of delivery methods and assessment feedback were used to enhance student's performance and cover the module learning outcomes. Applying the continuous assessments and feedback in such module will help to cover the following objectives:

- Motivate the student to give more and compete.
- Identify and differentiate the students' performance.
- Helping and improving the self-assessment approach.
- Course learning outcomes achievement level identification.

The design of this assessment ensures the capability to solve real-world engineering problems through multiple steps assignment and develop the practical skills starting from designing, modeling, analyzing the experimental data and compare with theoretical results and standard data. Furthermore, develop oral and written communication skills by writing the technical report and share their knowledge via presentation. In addition, this assessment approach helps to improve the collaborative and teamwork environment while working in project-based learning that particularly improve the leadership skills, planning tasks and achieving the project objectives as a team. Also, improving the moral and ethical responsibilities while applying the bioethics and academic integrity violation policy.

Applying performance-based assessment and combining various delivery and assessment strategies in collaboration with an industrial organization gives students the chance to practice real-world activities they could come across. In addition, they can use their abilities in a variety of contexts that are connected to the actual world through these activities. Furthermore, in this assessment working together is encouraged and help the lecturer better understand how students learn. On the other hand, and through lifelong learning this improve their ability to make sound technical reports and presentations, ability to communicate well, ability to innovate, ability to effectively involve in teamwork, and ability to update their knowledge.

To make sure the effectiveness of the performance-based assessment, and as per the teaching and learning approach the module leader needs to share the marking criteria with students early; the tasks need to be related to what has been taught and then to module learning outcomes; sharing samples from previous works to make the requirements very clear, and compare students' performance with each other that will encourage them and initiate type of

competition and enhance students' ability to self-assessment. Collaborative learning based on cooperation, problem-based learning, and active learning were therefore guaranteed.

The purpose and therefore the style of feedback may also be influenced by the assessment task and whether the main aim is formative or summative or both (Hughes, 2014). As a good performance is about course learning outcomes' achievements, direct feedback and marking with the presence of students adopted approach help students to develop self-assessment practices and help to understand and close the gap between the current performance and the expected performance with regards to module learning outcomes. This approach also encourages to open entire class discussion which help to enhance students' knowledge in a particular and required topics according to the module learning outcomes.

Through this type of assessment feedback, students can see their peers' work and use it as a benchmark for their own work and get sense of the academic standards in the program. It is type of dialogue between teachers and students which help in designing learning and assessment processes. Students in this type of assessment places at the center of the assessment practices which leads to good quality work. The direct assessment activity allows the student to demonstrate progress and change through repetition of activities or by comparing activities that address Similar knowledge and skills. These comments then inform the students whether they have made progress, or not, since the previous assessment.

5. Conclusion

Contemporary and Technology Based Assessment and Feedback methods for Student Enhanced Learning were presented in this study and various module delivery approaches presented as well. Various methods for module delivery have been adopted which provides an effective strategy to be employed in assessing student over time and enhance students' performance. Furthermore, case studies such as the Continuous assessments and feedback, Performance-based assessments, digitalized written comments, Direct feedback and marking with the presence of students, and Kolb's experimental learning cycle were

presented and discussed. The study shows that digitalize written comments to facilitate the feedback process particularly in case of high number of students, with specific and clear criteria will help to give the right feedback at the right time. Furthermore, conducting discussion sessions to get peer feedback and reflection indicated that the understanding of students on the given feedback was improved.

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