Contemporary Challenges and Solutions in Implementing Effective Peer Assessment for Engineering Subjects in the Jordanian Universities-Review

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Abstract

Assessment is one of the challenges facing higher education inside universities and it will be difficult to measure and monitor student's learning progress without a good assessment system. Today's students are digital natives, and visual learners, multi taskers, use technology to express themselves, information analysts, content producers, and real time learner's. Therefore, it is important to keep enhancing the recent assessment methods and tools in order to meet student's new abilities. One of the most innovative assessments is Peer Assessment (PA), which is an assessment that allows students to judge the performance of their colleagues. PA is a new and popular strategy for evaluating assignments and for minimizing the social isolation surrounding distance education due to the changes of the learning strategies in Jordan. It can be done in different forms depending on the learning activity purposes. The paper aims to investigate the peer assessment implementation for final year engineering students in project-based subjects and discuss how peer assessment can successfully be executed in these subjects. It also focuses on the early implementation stages to make sure that students and teachers are aware of the aims and instruction of peer assessment. Unique challenges are facing Jordanian Universities with respect to peer assessment implementation. This paper will comprehensively address these challenges and propose solutions in employing the non-traditional pedagogical practices of collaborative group learning and peer assessment. In addition, hybrid peer assessment is introduced as the first stage toward fully applying peer assessment.

Keywords: Electrical Engineering Education, Final Year Project, Peer Assessment, Higher Education.

INTRODUCTION

Over the last 2 decades, scholars have investigated the tools of education assessment and their methods in order to improve the learning process, maximize the educational outcomes, and discover the educational needs of the students. According to Phelps (Phelps 2014), without a good assessment system, it will be hard to measure and monitor student's learning progress. Furthermore, the learners of nowadays are significantly different from the

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previous learners, thus the assessment method and tools should be adjusted as well. Effective assessment methods have a vital impact on student behavior, university reputations, and also on educators' time as stated in (Sambell, McDowell & Montgomery 2012). Since assessment is one of the challenges facing higher education inside Jordanian universities, it is impotent to keep enhancing the recent assessment methods and tools. It is necessary to make sure that the assessment fits the purpose and context of the course and allows fulfillment of the Unit Learning Outcomes (LOU) by encouraging students to involve in learning activities, and this was hard to find in many universities. In addition, how students can gain teamwork skills, time management skills, and other soft skills without comprehensive assessments and various activities including face-to-face, online, and out-of-class activities that are presented to students in an efficient sequence (Canelas, Hill & Novicki 2017). In recent learning strategies, the assessment is authentic and integral to learning and guarantees students' engagement through formative feedback and product dialogue, as stated in(Bryan & Clegg 2019). In general, assessments must be carefully designed to measure particular elements of educational learning. In addition, the proposed assessment must be able to evaluate the outcomes of a 21st century education and demonstrate the students' achievement fairly. In the engineering education field, Project Based Learning (PBL) was found to enhance meaningful learning and comprehension of scientific concepts. Science and engineer educators recommend PBL as a leading instructional method for relating science and technology to students' daily lives, as well as supporting engineering knowledge (Jaime et al. 2016; Wengrowicz, Dori & Dori 2017). It also enhances students' communication skills and critical thinking (Barak, Watted & Haick 2016). The peer assessment is proposed to overcome this difficulty (Barak & Watted 2017). Peer assessment decreases the workload and resources required from the teaching assistants and aids in breaking the social isolation surrounding distance learning (Formanek et al. 2017).

Many authors discuss peer assessment and self-assessment together since both of them are dependent on the learners who are allowed to manage their own learning including creating their assessments (Harris & Brown 2013; Perera et al. 2009). Many experimental studies investigated and implemented peer assessment in various academic disciplines, such as peer assessment of English writing skills (Chen 2006), psychology modules(Topping et al. 2000), and science (Anker-Hansen & Andrée 2019). The targets of these studies are to develop students met cognitive ability and raise creativity in the classroom. Furthermore, it

was illustrated that peer assessment supports students in gaining technological skills such as programming, and can improve their problem-solving ability in programming courses (Jonassen 1996). The study in (Kobsiripat 2015) employed scratch as the programming language to allow students to generate their tasks; it was noticed that students became more creative since scratch is easy to use in the learning environment. Maya and Miri (Usher & Barak 2018) investigated experimental peer assessment in a project-based engineering course in terms of feedback quality and grading accuracy and the findings indicate a good enhancement was mainly achieved in the learning process.Attwell (Attwell 2007)discussed the reforming of learning strategies based on Personal Learning Environments (PLE), which gives learners control and allows them to manage their own learning including creating their assessments. Moskal *et al*. (Moskal, Dziuban & Hartman 2013) endorse peer assessment as a part of the reform approach for improving students' academic performance and increasing their satisfaction. In addition, literature reviews show that the use of the instructional approach based on peer assessment will increase students' motivation and engagement (Bloxham* & West 2004; Hanrahan & Isaacs 2001; Miedijensky & Tal 2009)and promotes the learning process(Jaime et al. 2016).

PEER-ASSESSMENT FORMS

Peer-Assessment can be in the form of summative purposes (e.g., peer grading, peer evaluation) or formative purposes (e.g., peer feedback). The summative assessment considers providing feedback often when it is too late to influence the result of the present task, although it would influence the production of future tasks (Topping 2010). Black and Wiliam (Black & Wiliam 2009) stated that formative assessment refers to applied assessment to extract information that may be used to adjust teaching processes and to better meet students' needs. Formative assessment has also been classified into three core activities: self-assessment, peer assessment, and teacher assessment. Peer assessment practices can take several forms including written comments, grading, or verbal feedback [17]. Feedback is a central role in formative assessment, to determine how successfully the student is learning, based on what is being taught, and in relation to peers and learning outcomes. It requires the educator to empower students grasp standards, make reflective comparisons with their own performance and take action to remedy any gaps that may be present (Biggs 2011; Watling & Ginsburg 2019). There is an argument for providing less tutor feedback to non-high-achieving students; instead, the tutor spends time enhancing these students' self-assessment capabilities,

fostering greater self-and peer feedback, promoting identity development, and strengthening inner feedback and meaning-making processes (Mak-van der Vossen 2019; Orsmond & Merry 2017; Watling & Ginsburg 2019).In addition, ttransformative assessment, which encourages students to make judgments and be actively involved in self-monitoring may be a way forward (Orsmond & Merry 2017). Further, being involved in selecting evidence and making judgments about their own performance and the performance of others is empowering for students and contributes to the development of lifelong learning skills (Biggs 2011). Learning, after all, is acquired cognitively (making sense), behaviorally (meeting outcomes), is socially constructed (making meaning), and occurs within the student and their context (Orsmond & Merry 2017). Feedback, therefore, needs to be multidimensional and supported by relationships and a learning culture. It was demonstrated that the main advantage of peer assessment is giving students a chance to learn by assessing a peer's work and offering students more engagement with the material. Besides, it enables students to improve their communication skills since they use similar language and speak together freely. Figure 1 illustrates the PA implementation cycle in learning activities.

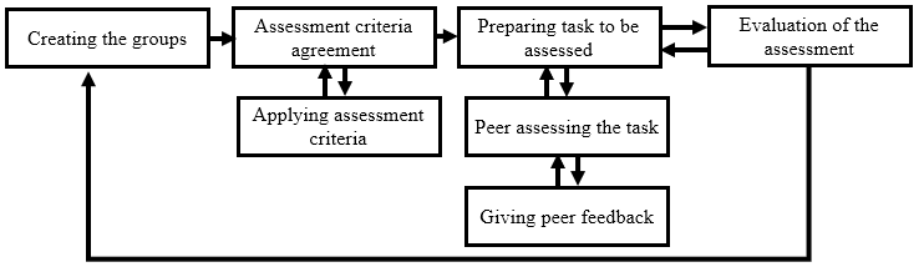

Figure 1: The PA implementation cycle in learning activities.

THE PRESENTED WORK

Although, peer assessment has been extensively addressed by scholars and researchers worldwide, no extensive studies have scrutinized PA in Jordan. The previous studies were focused on the effectiveness of PA, but they did not consider the existing challenges in its implementation, especially in Jordanian universities. Several authors have also illustrated the impacts of peer assessment in different sciences as stated earlier, but there is insignificant focus on peer assessment in the field of engineering subjects. This work will address these local challenges and propose solutions to employing the non-traditional pedagogical practices

of collaborative group learning and peer assessment. In addition, hybrid peer assessment is proposed here as the first stage toward fully applying peer assessment.

CHALLENGES OF PEER ASSESSMENT IMPLEMENTATION

There are three crucial challenges concerning peer assessment as an assessment tool that have been defined in (Anker-Hansen & Andrée 2019): (1) a lack of compatibility between peer and teacher assessment, (2) how learners employ peer feedback, and (3) the influence of social variables on learning activities of giving and receiving feedback. Esfandiari and Myford (Esfandiari & Myford 2013)also defined ethical challenges in the implementation of peer-assessment which related to the ethical background of the students. In this case, students may claim that peer assessors are biased and unfair. Furthermore, students may feel uncomfortable if their peers are assessing their work (Vu & Dall'Alba 2007).All these challenges exist in Jordanian universities but also others come from the local environment. If students are not psychologically prepared and given clear assessment criteria, the outcomes of peer assessment obviously have doubted as stated in (Mok 2011).This challenge becomes more serious since students in Jordanian high schools obviously have not been prepared for using their transferable skills. In addition, there are local challenges in Jordanian universities related to the absence of appropriate digital tools to implement peer assessment. The local universities are not serious about improving the assessment strategies and developing curriculum generally since they have other priorities. The excessive workload caused by the assessment in large classes and the need to provide proper feedback on time usually creates a rather heavy burden for teachers.

The reality and challenges of using peer assessment in Jordanian universities will remain unclear unless they are considered. Consequently, the main challenges of peer assessment can be summarized as shown in Figure. There is a different view was illustrated in the literature about how much PA can be used. Cassidy 2006 (Cassidy 2006) supported the piecemeal way of operating PA, although it should be embedded as practice in the university learning culture. On the other hand, Ballantyne *et al* (Ballantyne, Hughes & Mylonas 2002) suggested narrowing the use of peer assessment because overusing PA will lead to resentment of the technique. Jordanian universities must find how much PA can also be used depending on their learning strategies.

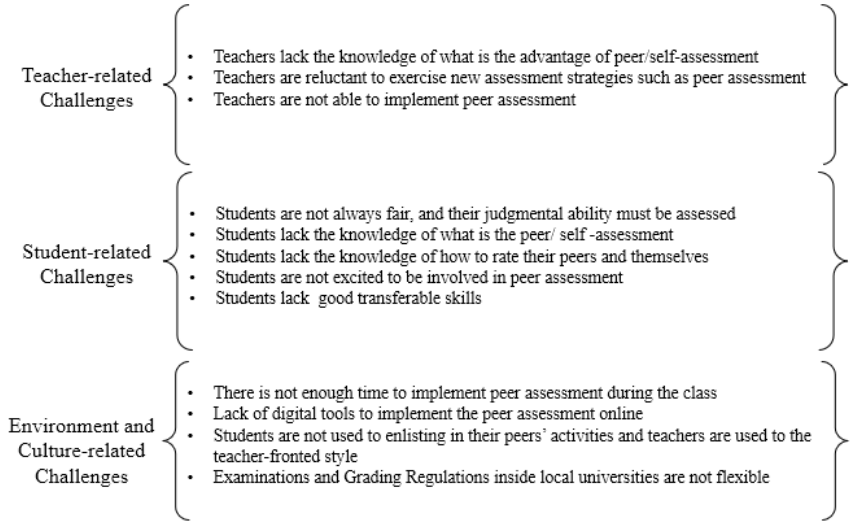

Figure 2: Challenges of peer assessment implementation.

PROBABLE SOLUTIONS OF IMPLEMENTING PEER ASSESSMENT

Peer assessment requires students to consider carefully the assessment aims, marking criteria, standards, and feedback when assessing their own work or their peer's work (Ross 2006). Therefore, students need to be ready for peer assessment during the initial implementation stage. This can be achieved by providing training sessions for students to make sure that they are aware of the aims and instruction of peer assessment. The preparation session is essential to address confidentiality and reliability in peer assessment (Biggs 2011). Jordanian universities must focus on improving the students' personal skills during the first year which allows students to easily involved in peer assessment. This can be done by redesigning the communication skills subject that is commonly given to the first-year student. The most important elements that are involved in creating effective peer assessment are the students and the assessment itself. However, there is a lack of studies that investigate the compatibility of these elements together to enhance academic performance. This is because of the difficulty of examining the various characteristics of peer assessment in one single study. Therefore, Double (Double 2018) investigated these variables using a meta-analytic approach. The approach analyzes the intervention in other studies that employ experimental designs to illustrate the effects of peer assessment on academic performance. It is a promising study and shows critical results related to measuring the performance of peer assessment in higher education. Miller(Miller 2003) illustrated that peer feedback increases by giving students specific prompts toward feedback. Hence, it is important when designing peer assessment to

consider the need for coaxing feedback out of students. Lecturers would develop a set of generic feedback prompts and rubrics. These could then be adjusted with more assignment-specific prompts where required.

Teachers must consider how to distribute work for peer assessment and think about whether to use peer assessment summatively or formatively. As shown in (Sluijsmans, Brand-Gruwel & van Merriënboer 2002), teachers also need to develop their assessment design skills to obtain their real value in terms of their potential to impact education inside universities. A range of digital tools can be used to improve the peer assessment policy and practice such as use of assessment boards and feedback benchmarking (including submission, marking and feedback). This practice, therefore, allows students to engage inside or outside their class and they can achieve a better experience. In addition, technology-enhanced assessment is necessary for online submission, security, and data protection [24]. Educators must recognize that new learners are digital natives and are becoming more connected to technology. Therefore, the peer assessment approach needs to reflect different contexts and priorities to achieve a better experience for the students.

Proposed Assessment Design for Engineering Subjects

This section will discuss a practical example of designing a hybrid peer assessment and then compare it with the traditional assessment. It is still required teachers evaluate the peer assessment marks and feedback in all stages, adjusting the marks when required in order to reduce the unexpected impacts on students' performance and mood. The peer assessment is designed for undergraduate students who attend a graduation project class at the Electrical Engineering Department in Al-Hussein Bin Talal University. The graduation project is a requirement for obtaining the BSc. degree in Electrical Engineering. In this subject, students work in a group to apply their knowledge in solving a complex and realistic problem. There are two major assessment tasks in the subject: major report and oral presentation. Both have specific requirements that students will need to meet in order to pass the subject. Peer assessment will be essentially employed in the report assessment. The current assessments have been investigated to maximize the learning outcomes and discover the educational needs of the students. The tasks were found demotivating for students and not convenient for the purpose. It is also noticed that students were not prepared for peer- and self-assessments. Therefore, the assessments will be adjusted by adding a clear task description to introduce

students to the course learning objectives. This will include a focus on the learner-centered approach for achieving student engagement, offering peer-to-peer assistance, and designing successful practices. Table1 summarizes the shortcomings of the current assessment and the proposed assessment that would overcome these shortcomings.

Table 1: Comparison of current and proposed assessments.

Proposed Assessments	Current Assessments
Require student to be prepared for the group assessments	NOT require student to be prepared for the group assessments
Monitor the student's progress (individually assess and evaluate)	Does not monitor the student's progress (individually assess and evaluate)
Offer Peer- and Self-Assessment The weighting of Peer- /Self-Assessments and (individual roles in face-to-face meeting) is 10 %	Does not offer Peer- and Self-Assessment
Encourages students to develop their transferable skills of collaboration, team-working, negotiation, listening, and organization, leadership and evaluation.	Not clear if it can encourage students to develop their transferable skills
It is required to exchange the group leader regularly and help students to get appropriate roles in the team.	It is not required
There is continuous written feedback and forward feedback provided to guide students' future learning. Lecturer and peer student are involved in providing feedback	General useless feedback Lecturer only provides feedback
Students are provided with enough academic support to learn and complete the project	Limited support provided
No exclusion and isolation, making sure all students are engaged	Marginalization of individual group members leading to a lack of engagement by particular students
The learning activities and resources must relate to the assessment tasks	Limited learning activities and they are not related to the assessment tasks
Ethical considerations are provided to the students in advance with clarification of the benefits, rights, and dangers of the project	Limited considerations

The proposed assessment scenario begins with asking the student to work in allocated groups and to write the project draft. These groups will be allowed to submit a draft report to get a grade, out of 10%, and written feedback for their peer in a different group. In the second stage, students will discuss the provided feedback with their peers before submitting the revised version of their report. The instructor provides also supplementary feedback and modifies grades. The implementation procedure can be described in steps as below and may be adjusted when requires. The peer feedback stages are included in the assessment process as shown in Figure 3.

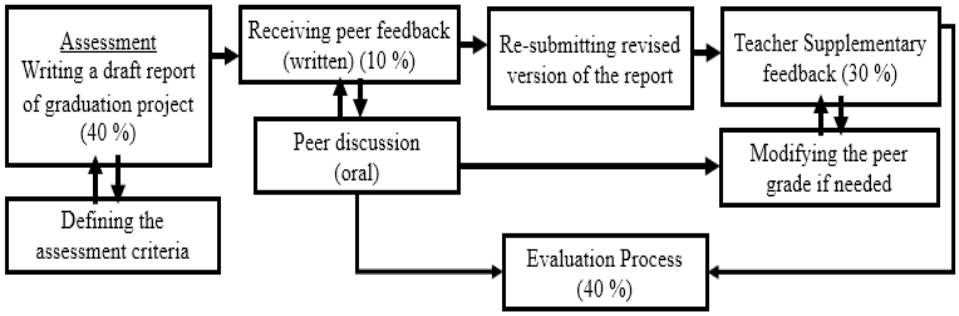

Figure 3: The stages of the proposed assessment.

The instructor prepares a training session to make sure that students are aware of the educational objectives and instruction of peer assessment. The instructor also reviews with students the assessment activities, the corrections criteria, and the techniques of giving and receiving peer feedback. Students must complete the draft of the report and upload it online within a certain time. The instructor randomly assigns reviewers, or selected students based on their academic performance. Each group of students, for example, Group A must mark and provide feedback for two other groups in the class (Group B and Group C). Group A can grade these groups in a couple of days considering what challenges these groups had faced in the assignment, what score Group B and Group C had achieved, and what Group A suggests improving their work. There will be two types of feedback: written feedback and oral feedback and both may be used. Students would meet in the library, for example, to collaboratively discuss the feedback provided. At this stage, the lecturer is still monitoring the evaluation and peer feedback provided earlier for their peers in the oral session. Students then receive notification of their grades and feedback and will subsequently have the opportunity to work in a group to negotiate how to use the received and given peer feedback. However, the lecturer shall allow students to work with whom they feel comfortable to work with (Harris & Brown 2013). The lecturer uses the feedback that students provided earlier for their peers to finalize the marks by adding supplementary feedback and modifying the grades if necessary. The lecturer could also request students to re-submit their assignments.

The analysis of the data will be conducted in several ways. First, the student's performance can be compared with the previous students' performance in the same subject. Second, it may conduct the experiment on one certain class (called the experimental group) and the students' performance of this class is compared with other classes of the same unit (called control groups) that learned with a traditional teaching strategy. When considering

students in these classes, they must have a similar educational background and should have learned under the same policy with the same curriculum. Moreover, study can illustrate how the feedback quality was enhanced by exchanging feedback between students and how students improved the re-submit assignment based on the peer feedback they received and provided. It also essentially measures how much students develop lifelong, transferable skills. A survey uses different experiment sets to explore the students' perception of the activity throughout the subject, and their behavior and academic performance using data obtained in the course.

Ethical and Practical Considerations

The ethics of educational assessments have been significantly developed over the last two decades due to the ever-increasing use of online educational assessments that have emerged more recently. The ethical dimension is a critical aspect in all assessments including peer assessments, which allow learners to engage in group work. Students and lecturers should participate in an induction training session before implementing peer assessments; moreover, the peer assessment must be fair consider students' abilities and the diversity of students' backgrounds. The lecturers should consider allocating the marks for assessment and allow students to choose the peer in their assessment because this has a significant impact on the outcome of peer assessments. In addition, students should be provided with clear guidelines on the peer assessment procedure and information on how to deal with challenges that may arise during the assessment process. The teacher should also manage the issue of students not distributing equally in peer assessment. He/ she may inform students that if the peer improves his/her re-submitted work, an extra mark will be awarded, which could be apart from the main marks. Peer assessment ethics must be clarified for the teachers, students and anyone involved in this experiment. Ethical considerations include providing the participants with comprehensive clarification, in advance, beforehand of the benefits, rights, and possible dangers as a consequence of their involvement in this experiment (Cohen, Manion & Morrison 2002).

CONCLUSION

This paper investigates the challenges of implementing peer assessment in engineering courses in Jordanian universities. The review shows that these challenges can be overcome by encouraging teachers and students to be jointly involved in the assessment design. This work

will be supplemented by a test involving the students and courses. A study needs to explore the relationship that exists between peer assessment efficacy and variables such as the scale schemes, the student knowledge level, and the knowledge fields.

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