Promoting An Assessment Practice for Modules in Computer Science

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***Abstract*—Assessment is perhaps the most principal and imperative feature of teaching and the curriculum. It powerfully frames how students learn and what students achieve. It has a noteworthy influence on the quality of learning. A review of various contemporary assessment strategies in the light of international best practice will be presented in this paper. In the computer science field, most instructors employ teacher-centered assessments to evaluate learners' performances. In this paper, we discuss how to adopt student-centered assessments in computer science modules. The application of these strategies will be analyzed with a specific module from the computer science discipline. This module offers students opportunities to build up some necessary problem-solving skills and to analyze and to disseminate some important concepts. The applied nature of the module necessitates a varied and multi-faceted assessment approach. In accordance with these analyses, some valuable suggestions on further enhancements are proposed in this paper.**

***Index Terms*—Assessment, constructive alignment, feedback, teaching and learning.**

I. Introduction

The teaching and assessment practice in post-compulsory tertiary education customarily concentrates on didactic tutor-led approaches: teaching is lecturer-centered, the focus is on what content the lecturer has to cover, teaching is largely held constant with lecturing the default method and assessment is norm-referenced. An abundance of pedagogical studies has demonstrated that this age-old approach to practice is not constructivism-based but cognitivism-based. Non-constructivism-based practice impedes rather than helps with learning. The intrinsic nature of teaching and learning in post-compulsory education prompts a need for change in the practice approach so that the teaching and learning quality is enhanced, particularly in the context of a sophisticated learning environment where the number of part-time students, mature students, and students coming from non-traditional backgrounds has hugely increased and, additionally, some of the students are from socio-economic groups who previously had little or no access to higher education. This new diverse population of learners necessitates teaching innovation in post-compulsory education with less focus on teacher-centered approaches and more concentration on student-centered and active learning activities. This teaching innovation should have a substantial impact on students' learning and on the improvement of teaching and learning quality. Because of this new environment, universities face substantial change in a rapidly evolving global context. This also means that assessment will need to be rethought and renewed. In the design of a curriculum, all teaching activities and assessment tasks should be properly aligned with the learning outcomes (LOs) to be attained. Regardless of the type of assessment adopted, the appropriate set-up of assessments and the lecturer's feedback can incentivize students' understanding of the materials delivered in the lecture room and stimulate their participation. Nowadays, many instructors still prefer to employ teacher-centered assessment strategies to evaluate learners' performances, particularly in the computer science discipline. Our intent was to promote student-centered assessment strategies in the computer science field. This article mainly demonstrates how theories and principles of assessment can be translated into practice within the computer science discipline.

The discussion commences with some background reviews of general assessment, constructive alignment (CA), and feedback. It draws on the expertise of a group of highly experienced assessment researchers, academic development practitioners and senior academic managers to thoroughly analyze how to apply good teaching and assessment practice to some imperfectly designed curriculums in the computer science field. Subsequently, according to these analyses, some refinements of these curriculums are suggested in this paper.

II. Background

A proper awareness of the role of assessment in higher education is of immense importance to every instructor. A considerable amount of assessment literature supports this viewpoint [1]-[3]. There is substantial evidence that assessment has a major impact on students' learning [4], [5], and the conditions under which assessment can support learning have been outlined [6], [7]. There are three primary perspectives on assessments: assessment *of* learning, assessment *for* learning, and assessment *as* learning [8]. Assessment of learning can be regarded as summative assessment; likewise, assessment for learning can be regarded as formative assessment [1]. Both summative and formative assessments have implications for learning and are vital inducements for learning. The correct adoption of an assessment strategy with a good underpinning principle [9] determines the pedagogical approach to be taken; for instance, the pedagogical principle underlying the summative assessment is cognitivism rather than constructivism. The design of an assessment task should be in strong compliance

Manuscript received July 9, 2018; revised November 3, 2018. This work was supported in part by the Teaching and Learning Unit (TLU) and the Computer Science Department in Cork Institute of Technology.

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doi: 10.18178/ijimt.2018.9.6.815

with the principle of both CA and good assessment and feedback practice [9]. Sally Brown [7] stated that assessment needs to be "fit-for-purpose". Rather than continuing to over-use unseen time-constrained examinations, instructors should unobtrusively design their assessments by taking the learning context and environment into account; instructors need to ponder what and how they are assessing, most importantly the rationale for assessing, who undertakes the task, and when is the best time to assess. As Sally Brown stated [7], assessments should be learner-centered and should strongly reflect a learner-centered curriculum; hence, the methods and approaches of assessment should devote their attention to evidence of achievement rather than the ability to regurgitate information. Assessment becomes valid if and only if the evidence of achievement used by the assessors clearly corresponds to explicit criteria, which are clear to all concerned [10]-[12]. Furthermore, any assessment strategy needs to be efficient, productive, and cost-effective. Present assessment literature strongly argues that the appraisal process should be transparent from the outset. Sally Brown suggested that any assessment strategy should deploy a variety of methods for assessment, and the programme of assessment chosen needs to be reliable [7]. All practitioners should adhere to the ten principles of good assessment and feedback practice presented by David Nicol [9] to design a flexible and effective assessment task for students. Nevertheless, these principles can provide appropriate guidelines on the application of technology to support assessment practices [13], [14].

In the “as learning” view of assessment, assessment is used to develop key graduate skills and attributes that may not easily be developed by other means. These skills are often associated with life-long and independent learners. In this type of assessment, the instructor feedback is mainly focusing on learners’ judgments of performance rather than the actual performance. Formally, [15] defined that self-assessment is comprised of two components – making decisions about the standards of performance expected and making judgements about the quality of the performance in relation to those standards. According to Boud’s definition, [16] redefined self-assessment as a process of formative assessment during which students reflect on and evaluate the quality of their work and their learning, judge the degree to which they reflect explicitly stated goals or criteria, identifying strengths and weaknesses in their work, and revise accordingly. The literature has also clearly indicated that there is a strong linkage between assessment as learning and formative assessment; for example, formative assessment can be improved by either self-assessment or peer-assessment. Self-regulation is another effective method for progressively diminishing instructors' scaffolding. There is a great deal of research evidence proving that students under-perform in assessment tasks because of a failure to grasp the requirements [17]. This can be easily clarified by sets of exemplars or supportively organized tutoring sessions. Engagement-empowerment and academic-social models are proposed in [9] for assessment as learning.

Summative assessment is "in disarray" [18]. This is mainly concerned with conventional marking systems and certification. It is essentially passive and does not normally have an immediate effect on learning. Furthermore, this customary assessment system does have a detrimental effect on the role of assessment standards in the light of several fallibilities evidenced by [19] and [20]. [21] pointed out that "conventional assessment procedures are unable to do justice to the most important outcomes of any educational process worth the name". Consequently, instructors need to recognize the difficulties inherent in marking systems and to address the imbalance between validity and reliability through an increased emphasis on assessment validity [22], [23]. To address all these criticisms, we no longer can count on this assessment system, and we need to turn to another active innovative assessment system that has a much more significant impact on learning. In this new system, validity and student achievement can be enhanced by assessment strategies that are programme focused [24].

Formative assessment is the advocated system where multiple criteria are used in making judgments about the quality of student responses. It has less relevance for outcomes in which student responses may be appraised as correct or incorrect. It tends to generate feedback on performance to improve and accelerate learning. Students' understandings are progressively refined through feedback. Research literature has argued that formative assessment has pivotal merits for refining students' learning [3]. Consequently, a raft of definitions, models, principles, processes, and reviews of formative assessment have been advocated in the literature [25]-[27], [4], [7]. Many definitions of formative assessment and claims made for its effectiveness have been established by different advocators. [28] questions whether the distinction between summative assessment and formative assessment has been over-simplified as these definitions and claims judge and measure the gaps in student learning. [29] discussed planned formative assessment and interactive formative assessment; the latter incorporates noticing, recognizing, and responding during the assessment session. Subsequently, they report that interactive formative assessment is often unreported in research studies as the lecturers were usually unaware that they were providing feedback [30], [31] defined formative assessment as a process used by instructors and learners during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of the intended instructional outcome. During this process, learners become more self-regulated [25], [32] expands this definition and argues that the function of this feedback is to help instructors and learners make adjustments that will enhance learners' achievement of intended curricula aims. Regardless of the type of assessment, each is closely bound up with feedback. Hence, feedback can also be categorized as summative feedback and formative feedback. It plays a vital role in formative assessment. Summing up, the effectiveness of learner engagement in learning can be improved through formative assessment. Particularly, informative and supportive feedback facilitates a positive attitude to future learning. Progressively, learners will gain their own ability to judge the quality of their own work and the work of others against agreed standards.

In the present teaching and learning system, there are three main unambiguously correlative components: curriculum,

teaching, and assessment tasks. These components should be integrated and fine-tuned to effectively support high-quality learning where there is a systematic approach to curriculum design that optimizes the conditions of quality learning. CA [33] is such a system. It is also a framework where all teaching and learning activities and assessment tasks are properly in compliance with the LOs to be attained. Properly implemented CA can be leveraged to improve teaching and learning activity, where it subsumes forms of quality assurance that can often be counter-productive. [34]-[36] introduced intended LOs, the design of the learning activities, and formative and summative assessment tasks that are all constructively aligned, interrelated and linked so as to enhance student learning. Once the curriculum is clearly stated in the form of clear objectives which lucidly express the level of understanding required [34], the teaching methods support the selected learning objectives. The assessment tasks must also support these learning objectives by encouraging students to actively engage in pre-designed learning activities. All the components must be aligned to support the intended instructional outcomes. Professor John Biggs [34] argues that if there is an alignment and a consistency between curriculum objectives, teaching and learning activities, and assessment tasks, then students will find it hard to "escape without learning". He also suggests that the objectives must be clear when they are defined and, in particular, think about the verbs used. This is also consistent with Benjamin Bloom's Taxonomy of the classification of the different objectives that educators set for students [37]. All the assessment tasks should mirror what we intend the students to learn [34].

III. Case Study

Graduates with an Honors Bachelor's Degree in Computer Science should possess good presentation skills, which encompass both writing and oral competencies able to clearly convey ideas in an integrated, authentic, coherent, and succinct manner, and proficient problem-solving skills. According to pedagogical studies, constructivism and active learning are the most recommendable approaches to be utilized for each instructor to enhance their teaching quality and students' learning quality. However, not all instructors are in favor of adapting their teaching and appraisal strategies. They may prefer their "academic freedom", meaning they prefer a more freewheeling approach adapting their teaching and assessment strategies based on students' learning requirements and progress and, most importantly, are able to change these strategies based on their own teaching needs. To promote a systematic teaching and assessment strategy, an intensive study of a curriculum has been conducted where we sought for some improvements on its basic design by answering the following questions:

1. What is the most suitable assessment strategy instructors should employ?
2. How do the assessment tasks and teaching activities align with the curriculum objective?
3. What improvements do we need to apply if the curriculum needs to be re-designed?

A. Module Description

The module we use in our case study serves as an introduction to operating systems (OSs). This module provides groundwork for other modules in computer science. The practical impact of OSs can be seen in "all walks of life". Their theoretical foundations and fundamental principles have taken decades of continuous insights and contributions from pioneers of computer science to establish. Their impact continues to grow in other emerging applications of computing, which in turn adds to the complexity, breadth and depth of the subject. This module aims to provide an insight into the underlying theory and practical aspects that make up this cornerstone of computer science. This module provides an overview of the major components of a computer system and their interaction with the system software.

This module, delivered in the second year of an honors degree programme, is a five-credit fundamental level module. It is delivered to students, who have little or no knowledge of this area, in the Cork Institute of Technology.

B. Learning Outcomes

There are six LOs to be attained (perfectly conforming with the following rule: "typically in a semester-length unit, there would be no more than five or six intended LOs, with some intended LOs addressing several topics" [33], [34]). These six LOs are illustrated in Fig. 1.

Learning Outcomes	
On successful completion of this module the learner will be able to:	
LO1	Describe the fundamental operation and structure of a computer system.
LO2	Explain the structure and management of processes.
LO3	Outline the fundamentals of memory management.
LO4	Install and configure a Linux Operating System.
LO5	Describe the Linux operating system organisation, components and file system.
LO6	Use the Linux graphical user Interface and command line interface to perform standard user and administration tasks.

Fig. 1. The LOs for the OSs in practice module.

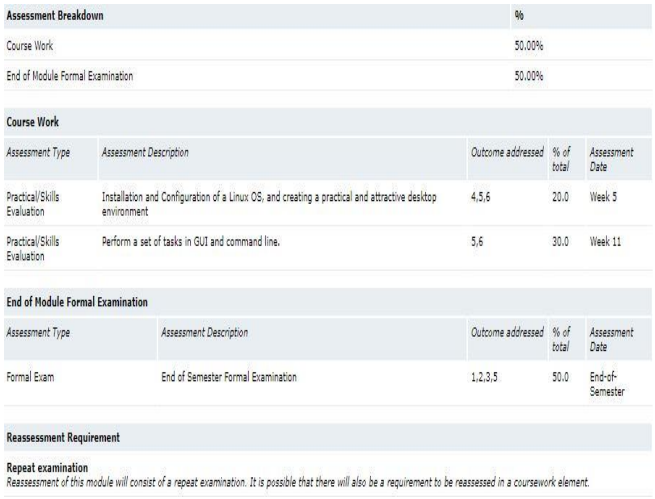
These LOs are written towards the intermediate end of the cognitive domain of Bloom's Taxonomy to include regurgitating factual concepts, demonstrating an understanding of knowledge and applying this knowledge [37]. This means that these LOs fall within a hybrid of the multi-structural and the relational levels in the hierarchy of verbs defined by [34]. Fig. 2 shows the assessment breakdowns described in the curriculum.

Table I provides an overview of the module under Bigg's headings for CA. In LOs 1, 3, and 5, the words "describe" and "outline" require learners to be able to assimilate all pivotal concepts and to eloquently articulate them with their own wordings. This completely concentrates on what instructors expect learners to achieve and it is the minimum standard to be obtained.

Similar to the verbs used in LOs 1, 3, and 5, the word "explain" in LO 2 requires learners to fluently describe all important points with their own expressions after assimilation of these concepts. Additionally, this requires learners to demonstrate their comprehension of these concepts. This obviously represents another higher level compared to the minimum level required by LOs 1, 3, and 5.

In LOs 4 and 6, the words "install", "configure", and "use" require learners to turn declarative knowledge into functional

knowledge by skillfully applying their acquired knowledge to solve some professional problems.



Assessment Breakdown	%
Course Work	50.00%
End of Module Formal Examination	50.00%

Course Work

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	Installation and Configuration of a Linux OS, and creating a practical and attractive desktop environment	4,5,6	20.0	Week 5
Practical/Skills Evaluation	Perform a set of tasks in GUI and command line.	5,6	30.0	Week 11

End of Module Formal Examination

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Formal Exam	End of Semester Formal Examination	1,2,3,5	50.0	End-of-Semester

Reassessment Requirement

Repeat examination
Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.

Fig. 2. The assessment breakdowns stated in the module descriptor.

TABLE I: A REVIEW OF COMP6042 THROUGH THE LENS OF CA

LO	Curriculum Objectives (Expressed as Verbs)	Teaching and Learning Activities	Assessment Task
1	Describe	2 * lecture	Formal Written Exam
2	Explain	2 * lecture	Formal Written Exam
3	Outline	2 * lecture	Formal Written Exam
4	Install, Configure	2 * lecture 2 * practical lab	Practical/Skills Evaluation
5	Describe	2 * lecture	Formal Written Exam
		2 * practical lab	Practical/Skills Evaluation
6	Use	2 * lecture 2 * practical lab	Practical/Skills Evaluation

We expect learners to be able to install a particular OS in a computing device. After successful installation, learners are capable of utilizing some professional administrative software tools to configure and monitor different processes and components in the system.

C. Teaching and Learning Activities

Sticking with Bigg's theory on CA, the teaching and learning activities should help to activate the required verbs from the LOs. These verbs need to be embedded in these activities [34]. The formal contact time is divided into two hours of theory lectures and two hours of a laboratory in a computer lab.

The teaching method has largely remained constant with lecturing the default method. It focuses on what declarative knowledge the instructor has to cover so that learners can absorb this to attain the targeted LOs. Lecturing is the most common and plausible methodology to impact the theory-based material, which is required for these LOs, to learners.

Course delivery for LOs 4, 5, and 6 is done through two different stages. Theoretical materials are delivered through lectures beginning with an initial review of background knowledge on slides. Due to the inherent difficulty of this module, learners can easily lose concentration after 10-15 minutes if the approach to learning is not relevant and meaningful to learners. The skills needed to apply these theoretical concepts are demonstrated in the computer lab. In a computer lab, learners actively re-apply these demonstrated skills via some practice questions. To answer those practice questions, it is vital that learners need to figure out what programs, procedures, and configurations need to be installed and written prior to the completion of tasks. Usually the instructor will advise learners to construct a feasible plan before the actual implementation. During the first half of a lab tutorial, the instructor only demonstrates what each command or software does and how to apply theory to a real small concrete application.

Therefore, the teaching activities have been aligned with the intended LOs of the module, but they do not actively encourage learners to engage with their learning. As the learning environment is not constructive, learners are likely to engage in surface learning. As 50% of total assessment marks are determined by a final written exam, learners are prone to forget everything they learned and lose the ability to re-apply their knowledge to solve real life problems. Hence, constructive teaching and active learning activities play a vital role in stimulating learners to actively engage with learning.

D. Assessment and Feedback

Instructors need to be able to have evidence that learners have achieved the required learning to progress to the next stage. This module is appraised by two assessment components. The first component is an unseen written terminal examination. It is worth 50% of the overall course mark and is a way to test factual knowledge. In the final exam, there are five long questions to complete and each of them corresponds to a theory element that mainly focuses on all LOs. Learners must complete four questions in two hours and each question carries equal marks. In particular, the other two LOs 4 and 6 are also tested in longer type questions that require learners to use their programming and problem-solving skills to solve some configuration problems and some real problems using a specific shell scripting language in a limited timescale. Most learners tend to have a good performance on the practical/skills evaluations held in a computer laboratory, but they usually perform poorly once they are required to solve some problems with pen and paper within limited time constraints. In this way, individual learners' programming skills and problem-solving skills can be appraised properly especially when they are under examination pressure and under time constraints. This method of assessment and lecturing delivery for this module supports the notions of "describe", "outline", and "explain" in LOs 1, 2, 3, and 5.

The second assessment component is a skills/practical evaluation. It is worth 50% of the overall course marks. It consists of four lab assessments. Learners will be assessed every two weeks. Each lab assessment must be completed in a two-hour practical computer laboratory. The easier lab assessment is worth a lesser percentage and the more challenging one is worth a greater percentage. The difficulty of the questions becomes progressively higher. The first lab assessment is the easiest one and mainly focuses on the installation of a Linux operating system in a virtual machine and solving some fundamental problems with basic shell scripting and then debugging them via the command line. The

second lab assessment concentrates on solving some sophisticated problems, such as problems with arithmetic operations, or selective decision-making, or iterations, or using advanced shell scripting. The third lab assessment is about network configuration, user account management, and process scheduling. The final lab assessment is about disk partitioning and how to manage all user accounts and processes after a disk partition. All questions in the lab assessments are closely related to a series of practical exercises presented in the weekly lab tutorial, the learners are essentially applying their learning in an exam situation. Should the learners follow the presented examples in the weekly tutorial, they are fully set up for success in the end of term exam.

Table II shows a summary of the most likely kind of learning assessed by the assessment modes used in this module. The relationship between the assessment components and the LOs is summarized in table III where the relative strengths of correlations between LOs and the assessment components are indicated.

Learners cannot pass this module without meeting all LOs. Comparing Tables II and III with the intended LOs for the module, the summative assessment is aligned with the learning objectives for this module.

For all of the LOs, a study pack, containing lecture notes, sample papers and practical problem sets, is provided to all learners. This is the only material used in lectures and lab tutorials by all instructors teaching this module. There are standard solutions for all questions presented to instill standard approaches or techniques to solve all problems. When a lab assessment is completed, all of the solutions are reviewed with instructors including the marking scheme to show learners where marks are awarded. This method is used in place of a marking rubric and lab discussions.

There are two huge pitfalls in using an unseen terminal written exam. One of the criticisms is that there is currently no feedback loop after the final written exam to alert learners to how they performed, where their weaknesses and strengths lie, and where they need to improve. Unlike simple recall knowledge which is either correct or incorrect, ensuring that learners grasp LOs 4 and 6 is trickier. The risk is that learners will carry on making the same mistakes if they cannot comprehend where the mistakes are. The second criticism is learners can freely choose to answer four out of five possible questions. In this way, learners are tempted to opt for easy questions and to avoid the questions they are not confident about; learners can attempt to hide their weaknesses in this format of assessment. Another shortfall of skills/practical evaluations is that feedback, apart from the actual grades, is likely to be ignored by most learners.

TABLE II: RELATIONSHIP BETWEEN ASSESSMENT MODE AND LIKELY KIND OF LEARNING ASSESSED

Assessment Mode	Most likely kind of learning assessed
Unseen terminal exam	Recall units of information, level of understanding
Case Study, Problems	Application, Professional Skills

TABLE III: RELATIONSHIP BETWEEN THE ASSESSMENT COMPONENTS AND THE LOS

LO	Final Written Exam	Practical/Skills Evaluation
1	Very Strong	N/A
2	Strong	Weak
3	Very Strong	N/A
4	Weak	Strong
5	Strong	Weak
6	Weak	Strong

Module Workload

Workload: Full Time

Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Presentation of theory components of module.	2.0	Every Week	2.00
Lab	Practical work on Linux operating system.	2.0	Every Week	2.00
Independent Learning	Study of theory components and preparation and practice of practical work.	3.0	Every Week	3.00
			Total Hours	7.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	4.00

Workload: Part Time

Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Presentation of theory components of module.	2.0	Every Week	2.00
Lab	Practical work on Linux operating system.	2.0	Every Week	2.00
Independent Learning	Study of theory components and preparation and practice of practical work.	3.0	Every Week	3.00
			Total Hours	7.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	4.00

Fig. 3. Workload for the module.

The syllabus of this module does demonstrate that CA exists; however, there are some deficiencies in transferring these theoretical points into practice:

1. Due to the class size and the method of delivering the course content (lectures), it is difficult to keep learners interested for a full lecture and very often instructors will see learners lose concentration after a short period of time. This conventional teaching method has not much evolved recently. However, the teaching audiences have changed a lot: the majority of them belong to the millennial generation and the learning environment has adapted and changed as well. This does change the way they learn and interact. Psychologists have found that the formality of the traditional lecture and delivery mode is not what works best to engage these millennial learners. We need to evaluate how to reach and teach them [38].
2. Fig. 3 illustrates the distribution of workload for this module. In the syllabus, it states clearly that every learner should undertake at least three hours of independent study. Apart from the weekly laboratory tutorial and exercises, there are no other activities to support learners' independent study. Basically, learners freewheelingly perform and organize their independent study without any proper guidelines and supportive activities.
3. Due to the nature of summative assessment, feedback given for practical/skills evaluations is usually ignored by most learners and no feedback loop is generated for a final written exam. Learners only care about marks. Learners have little or no motivation to explore further knowledge outside of lectures.
4. The grades received by learners do not holistically and truly reflect their learning quality, and their weaknesses can easily hide behind those marks.

5. The lab assessment is an appropriate means of evaluating how well learners grasp the concepts and apply those concepts to skillfully solve some real problems. However, this approach can lead to an over-simplified assessment picture; there is not enough variety in activities to appraise learners' problem-solving skills. There are not enough feedback interactions to complement all assessment components

E. Assessment and Feedback Enhancements

To address the above deficiencies, a design for a new interactive formative assessment strategy for this module is proposed.

1. The monotonous 50% final written exam can be divided into two parts. The first part will consist of a series (in total worth 20%) of either *short questions and answers* (SQA) tests or multiple-choice questions (MCQ). These can be administrated weekly online. As Sally Brown mentioned that assessments should be learner-centered, instead an instructor decides the type of questions to be assessed, learners can vote to decide whether they want to be assessed via MCQ or SQA. According to the voting result, the instructor can inform each learner to post some questions relevant to topics delivered in the lectures in advance onto the Blackboard learning management system according to the exemplars and guidelines provided by the instructor. It is the instructor's responsibility to review and filter those questions and collect them into a bank of questions. The learning management system (in this case, *Blackboard* is used) randomly selects three questions for each learner. The learner has only one attempt and is obliged to complete these questions in a limited time frame. The instructor has the responsibility to set up a standard rubric for assessing the weekly SQA/MCQ. Learners will directly receive grades for these weekly SQA/MCQ assessments and instructor's critiques based on a preset rubric.
2. It is obligatory for learners to self-evaluate their own performance according to the instructor's feedback and to justify their self-evaluations. Finally, the instructor will supplement the feedback, not only with grades but also with a holistic feedback assessment, to reflect the holistic performance of each week's SQA/MCQ assessment according to learners' feedback (self-evaluation outcomes and justifications). In this way, the instructor's feedback will not be wasted and ignored. Particularly, the instructor can tailor questions in later sections according to commonly received feedback given in earlier sections. Additional informative references on how to perform self-evaluation will be supplied as an exemplar to learners so that learners can foster their competence and ability in how to fairly evaluate their own work. The instructor can easily see how well the learners have grasped what they have learnt in the lecture, and it is important that the instructor has an open discussion about the rationale behind the process of running the SQA/MCQ before starting this type of assessment. The second part will be a 30% unseen final written examination.
3. The monotonous 50% practical/skills evaluation can be split into two parts. The first part will be a 20% series of weekly blog discussions. An instructor has the responsibility to open a weekly blog discussion board in the Blackboard system and to supply a research paper or reading material relevant to topics covered in the lectures. In this blog discussion board, learners can freely and actively express their viewpoints about the supplied reading material. The instructor can easily monitor and gauge learners' progress and comprehension level through these blogs. This creates an open discussion to attract learners' participation and to explore some materials that are not properly explained in lectures. Sometimes the instructor can impose some interesting questions to stimulate learners' commentaries. The second part will be 30% in lab assessments. The original structure and content of lab assessments remain unchanged. Every lab assessment is a medium-sized open-ended project. But the instructor applies the same interactive feedback strategy used in SQA tests to appraise performance based on learners' submitted lab reports. The instructor needs to supply some exemplars to clarify his/her expectations and understandings of the problems. The instructor should make a final holistic adjudgment based on the overall learner's activities engagement, interactive feedback quality, problem-solving ability etc. All these analytical results provide a good justification for learners' performances and could be useful to all external examiners for making another holistic appraisal.
4. To smooth the assessment process, open discussions and criteria will be provided by both on-line discussion and special workshops every two weeks. Learners and the instructor can discuss the nature of the assessment process and guidelines on evaluation of assessment.
5. To help learners to be able to disseminate what they learned in the lecture hall, an interactive mini task (using H5P technology) will be set up for each week.

F. Evaluations

An effective assessment strategy would seek to measure how the learners can put into practice the learning achieved [7]. The methods of assessment used need to be authentic, valid, reliable, efficient, integral, transparent, and inclusive [7], [39], [40]. The proposed new assessment strategy and the criteria for good assessment are mapped out in Table IV. The use of rubrics increased the reliability and efficiency of several assessment elements [41], [42], [39] and ensured that the assessment criteria were explicit and clear to all concerned. Table IV also demonstrates that this assessment strategy does include a variety of assessment methods. [7] clearly states that "for an assessment strategy to be inclusive a variety of assessment methods should be used to ensure that the same students are not disadvantaged". The feedback learners received will maximize their learning. As a final part of our evaluation, it is important to see how the overall assessment strategy rates against best practice. Table V reviews the overall assessment strategy and compares it against the 11 principles of good practice of formative assessment and feedback proposed in the REAP project [9].

TABLE IV: AN EVALUATION OF THE OVERALL ASSESSMENT STRATEGY USING STANDARD PRINCIPLES OF ASSESSMENT

Criteria	SQA	Written Exam	Blogs	Lab Assessment
Mode	Formative	Summative	Formative	Formative
Authentic	Yes	Depends on Content	Yes	Yes (It is an open-end project)
Reliable	No	Yes	No	Yes-Rubric
Valid	Yes	Depends on Content	Yes	Yes
Efficient	No	Yes	No	No
Integral	Yes	Depends on Content	Yes	Yes
Transparent	Providing criteria	Yes	Providing criteria	Providing criteria

TABLE V: A REVIEW AND COMPARISON OF THE OVERALL ASSIGNMENT STRATEGY AGAINST BEST PRACTICE

Principles	Present
Clarify what good performance is	**Strong:** all learners are provided a marking scheme for exam questions and sample answers, and a bank of SQAs. All materials are shared on the online Blackboard learning system.
Encourage time and effort on challenging tasks	**Strong:** Blog discussions, SQA/MCQ
Provide high quality feedback that helps learners self-correct	**Strong:** instant feedback from MCQ, lab assessments, SQA
Provide opportunities to act on feedback	**Strong:** lab assessments and SQA
Encourage interaction and dialogue around assessment	**Medium:** Blog discussion and SQA
Facilitate the development of self-assessment and reflection	**Strong:** SQA and lab assessments
Give learners choice in assessment	**Weak:** all components are compulsory
Involve learners in decision making about assessment policy and practice	**Weak:** This is managed by the department and instructors
Support the development of learning communities	**Weak:** team work is not recommended. The current approach prefers individual study
Provide motivation and enhance self-esteem	**Medium:** SQA/MCQ, Blog Discussion
Help instructors adapt teaching to learners needs	**Medium:** Limited due to time constraints and content to be covered

IV. CONCLUSION

Assessment addresses the needs of third level education, and it provides a measure of learning achieved by learners. It makes more difference to the way that learners spend their time, focus their effort, and performance than any other aspect of the course they study, including teaching [43]. Assessment must also contribute to the development of the skills and capabilities of students to be effective learners [4].

Various assessment methods can assist learners to develop skills and assessment practices that they will be able to use throughout their lives and careers. The assessment strategy should be supported by feedback on formative assessments. It is important that learners receive their feedback as promptly as possible before they move on to further learning content. If the proposed assessment strategy was implemented, it may address the deficiencies identified in the last study. In theory, this proposed assessment strategy does improve learner-focused learning experience and quality. However, actual practical results on the ground do not always match theoretical expectations. Therefore, the authentic effectiveness of this proposed strategy in practice needs to be evaluated. This will totally depend on external resources to support the implementation of this strategy.

If I was to reflect on my teaching and learning practice, several questions run through my mind:

1. How to maintain enough attention in learners to improve the quality of my teaching?
2. Do assignments and evaluations have to be this way? Are there alternatives that I could consider that would better distribute the work?

Over the past 5 years that I have spent teaching, some disengagement by learners has clearly manifested itself when didactic approaches have been used. This may be because the overall teaching-learning environment may need to change. The results of a student feedback survey I conducted last year indicate a need to promptly transform this conventional teaching-learning environment to an active learning one where I can better stimulate learners' participation and thinking by posing some interesting questions and open discussions. It may be possible to increase learners' engagement by designing a series of assessments as diverse levels of games. The most important thing I have learned from my learners is the importance of assessment designs. Wrong assessment strategy can seriously hamper students' learning. When I design an assessment, alignment of learning outcomes is important; however, feasibility, reliability and transparency are crucial as well. It is pointless to design an assessment that is infeasible. Another important thing that I learned about assessment is that the rationale of the assessment and learners' workload should be taken into consideration when I design assessments for a module. In comparison to this time last year, I am now able to design/write a written exam paper without violating reliability, validity, and transparency. I now also know how to change summative assessment to formative assessment, how to promote self-assessment and peer-assessment, how to recycle feedback and to use advanced technology (like audio feedback) to provide feedback to a huge class, and how to correctly set up a rubric to evaluate the performance of learners. In terms of assessment, a beneficial approach may be to more greatly focus on the process of evaluating and completing/undertaking assessments/projects instead of merely determining if they are right or wrong. This approach holds out the promise of both better maintaining the quality of teaching and simultaneously providing a better learning experience for students.

APPENDIX

The curriculum of the analyzed case study is available at the following link: https://courses.cit.ie/index.cfm/page/module/moduleId/12705

ACKNOWLEDGMENT

I would like to express my great gratitude to Dr. Tom O'Mahony of the CIT Teaching & Learning Unit for his valuable feedback on this paper.

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