Work Integrated Learning (WIL) and Integrated Assessment in Manufacturing Engineering

Shivanand Ganachari¹, Songlin Ding*², John Mo³
School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University, Melbourne, Australia
¹s3253738@student.rmit.edu.au; ¯songlin.ding@rmit.edu.au; ¯john.mo@rmit.edu.au

Abstract
The demand for work-ready graduates with the knowledge of organizational practices in industry is increasing, and so the need for greater work integrated learning (WIL) in the education sector. With the globalization of higher education and the cultural and linguistic challenges this brings, WIL has become a core strategy for many institutes to attract students. This paper presented a WIL platform and corresponding integrated assessment approach, and the guidance on preparing effective learning objectives so that students are ‘work ready’. The relevant techniques such as ‘Scaffolding’ and peer assessment were discussed to ensure students gain the pre-requisites to enter the workforce once graduated. The WIL and new assessment approach provides students with the platform/confidence which contributes to their engagement in learning and be a team player as well while learning different things.

Keywords
Exams; Work Integrated Learning; Assessment; Manufacturing Engineering

Introduction
There are always different views when it comes to the concept of just having exams to demonstrate how competitive students are. If students have exams they can know our real knowledge and through exams students can demonstrate that they can control their nerves but unfortunately this does not prepare the students for the real world situations of a manufacturing industry.

Work Integrated Learning (WIL) is certainly not limited to formulating students for jobs but rather it is an enlightening and knowledge approach which has the prospective to offer a healthy, active and intentional learning experience for students to ensure that contributes to their commitment in getting educated. The fundamental idea is to get students engaged in a variety of academically dedicated experiences.

WIL and Integrated Assessment
Given the special characteristics and practicality requirements of manufacturing courses, a virtual practice-oriented WIL platform was developed in the School of Aerospace, Mechanical and Manufacturing Engineering, RMIT University. The new WIL platform was developed to simulate the real product development process in the industry for students who do not have factory operation knowledge. This platform provides the students with an opportunity to apply theoretical knowledge gained in academic studies to “real world” work place practices. With a focus on manufacturing, the process can cover the entire product development cycle from the very beginning of concept and production design, all the way to the final stage of CNC machining of the product. What students experienced on this platform are exactly the same as those an engineer is exposed to in a manufacturing company: commercial edition of CAD and CAM software, industry scale CNC lathe and milling machines, risk assessment and OHS requirement, project planning and project progress meeting, professional documentation and report, and so on. The availability of this platform can enable students to work in the simulated industry environment and foster their team work, leadership and product development skills.

Learning in work placements needs to be thoughtful and purposeful, reinforced by initiation of students and managers and the imaginative development of appropriate assessment to ensure the maintenance of high standards and adequate duty of care (Washbourn, 1996). Reflection and debriefing on the work by all parties is required [1, 2]. Assessment provides valuable feedback to measure student performance. Based on this notion, lecturers can make corrections to teaching procedures to further improve student education.
Manufacturing courses are unique in their demand for practical application. The efficacy of the assessment strategy is one of the key components in developing a high quality curriculum.

As part of an integrated learning framework, we developed a new integrated assessment approach to effectively assess students in manufacturing courses. This new approach included peer assessed in-class discussion, specially designed oral tests, and project based examinations. Different modes were designed to cater for different modules in each subject. Assessment of students’ abilities was conducted by simulating the development cycle of real products including concept design, manufacturing process design, tool path generation and CNC machining. Through effective assessment, students were able to identify their strengths and weaknesses, observe their personal learning progress, and improve their learning processes to accomplish learning outcomes.

Assessment

If the educators present assignments/assessments without any association to learning objectives are often just giving students ‘busy work’. Accurate awareness is achieved when students power subjective meaning in some form to the information being conveyed. Learning objectives promote in helping students achieve desired outcomes. By stating the desired outcomes in terms of the student and what you want them to achieve, you can create activities that foster learning. According to (Wong and Wong, 2004) there are twelve ways professional educators can promote students growth in their classroom. The recommendations that the Wong’s presented, will undeniably help students to accomplish and reveal their abilities. According to Wong’s suggestions, teachers can prepare their students to be successful on these tests while promoting and developing important skills [3]

Work Stream

Ensuring that Assignments Have Correct Purpose.

According to Prof. Allison Boye from Texas Tech university, assessment is a necessary part of the teaching and learning process, helping us measure whether our students have really learned what we want them to learn. Unquestionably, numerous instructors have been on the receiving end of unsatisfactory student work, left speculating what went wrong and often, those problems can be improved in the future by some simple fine-tuning of the original assignment [4].

Clarify the Learning Objectives of the Course

It is critical to relay all teaching tasks, classwork, assignment, and assessments to written objectives. Apart from these being part of your learning objectives, they should also be clearly illustrated to students so that the students understand what you are trying to teach. These objectives should be referred as often as possible in the teaching lessons so that students can see the connections. Assisting students to see what you are enduring to teach them can help increase student’s learning motivation.

Write Excellent Objectives

The primary step in generating operative lessons and assessments is having effective objectives to begin with. Excellent objectives help students to learn and give an indication of how teachers will assess their progress. Following are examples of both poor and well written objectives:

- Knowing the periodic table after completion of lesson is a poorly written objective in that it does not specifically state what the student needs to ‘know’.
- Conversely if the student will be able to explain how the position of an element on the periodic table relates to its atomic number is a well written example.

Create a Set of Questions for Each Objective

The next step when creating an objective test is to go through each of the objectives on the list and create a set of questions for each objective. This will help you get a good handle on how well the students have met the goals set for them. This could be in the style of a production check sheet where the teachers can tick off the objectives and also it will be great if the teachers have a scale to measure the efficiency of each objective met.

Map every Question to a level of Bloom’s Taxonomy

Usually lecturers prepare tests built on the lowest two levels of Bloom’s Taxonomy. Nonetheless, we should attempt to contain questions from advanced levels of the taxonomy to ensure students to demonstrate thinking rather than recalling material. If we map each question, we can guarantee that there is a satisfactory balance.
Generate a Guide for Correction for Each Question

Although this will put some additional workload on the teachers, it can be priceless when helping students who are stressed with specific theories in the class. It is of paramount importance for teachers to make a note for each question so that students can refer text or their own notes to re-confirm the information that they overlooked in the test. After grading, teachers should provide students with this ‘key’ so that they can relearn the material before progressing to the next level or component. Teachers can take the next step and gather alternative teaching resources in addition to those already used for each objective. Students that may have struggled need a different methodology to challenging concepts. Yet again, this will incur time and dedication on teacher’s part, but on the flip side teachers can reap rewards which will be huge in terms of students’ development and learning.

Elucidate Class and Homework Objectives

When the assignments are given out, teachers need to ensure that both teachers and students achieve the learning objectives set out for the current lesson. There is notion with some teachers that providing this information is not necessary since many students will ignore it. Nevertheless, that is not the point of presenting it. Providing it to the students gives extra level of penetration and also helps answer questions asked by anyone (inside or outside of institution) concerning teaching methods.

Elucidate the Anticipations of all the Assignments

The key to success is to be upfront with students about expectations from them. They should know how to at least achieve a passing grade for all assignments. If the students have an assignment about a research paper or essay which can be very subjective, teachers need to present them with a detailed understanding how they will be graded. Teachers should take the following steps teachers to help the students:

1. Provide outline and scope of the assignment.
2. Structure the list from most important to least important. Ex: Pareto Chart.
3. Provide overall point value for the assignment.
4. Allocate a ranked list of percentage value out of 100 percent.
5. Allocate specific grading criteria for each main category.
6. Pre-populate and present outlines and expectations on presentation paper in class. Ex: .ppt presentation.
7. Make it very clear of the possible exam questions so that students understand the significance of certain topic.

The last point is not to suggest creating simple assignments just so that students will be successful, the intention is to make sure that the directions for given assignment are flawless, making students understand exactly what they need to do to succeed. If a complex activity is required for learning to take place, then be sure to provide scaffolding [3,4]

Scaffolding

Scaffolding denotes to the idea that particular instructional supports need to be in place in order to best enable learning when students are first introduced to a new subject. Scaffolding teaching defines tailor made teaching tactics aim to enhance learning when students are first introduced to a new subject. Scaffolding provides students the context, motivation and foundation to enable easier grasping of the new subject to be taught. Considering the aim of the WIL is to have students ‘work –ready’ scaffolding skills, to help students from various backgrounds and abilities and to ensure that the beginning of any subject is crystal clear relating back to examples from workplaces or communities..

Scaffolding training contains an extensive variety of strategies, including:

- Motivating student interest or curiosity by explaining the benefits in the workplace.
- Simplifying the complex task into more manageable steps
- elaborating students an example of the expected result before they accomplish the task
- Demonstrating the thought process to challenge them to think outside the box.
- Enabling student engagement and participation through class exercises.
- using pictures to offer a visual framework thus integrating novel information
- Encouraging students to make predictions for certain outcomes in real –life.
- Engaging students by asking questions based on experience and knowledge.
- Encouraging students to contribute with their individual experiences that may enhance a particular process or practice.
**Group Work and Assessment**

Self and peer assessment helps students judge how they and others work together collaboratively. This is an imperative characteristic students should have as a graduate to create a more appreciated person in a work environment that use team- and group-based work processes. As a group member, students become responsible for negotiating and managing the balance of contributions and then using self and peer assessment whether the balance has been achieved.

Formal peer assessment helps students assess their progress on achieving the group task. It also encourages group members to consider how they might improve group performance and the performance of individual contributions. Throughout their working lives, engineers will need to assess the quality of the work of their subordinates, their peers, their superiors, and realistically, themselves. The ability to critically and objectively judge the performance of peers is a skill that students should possess when they enter employment in industry.

**Limitations**

Although techniques such as learning objectives and scaffolding are great pathway for WIL, it relies on the lecturers to have comprehensive knowledge of the objective setting rather than just the subject knowledge. Not everyone can structure the objectives effectively and it is sometimes hard to determine the balance between the workload of students and effectiveness of the objectives. Better training of the lecturers is certainly an aspect which can be considered to improve effectiveness. There are some issues with peer assessment as well which include the vagueness about the validity and reliability of peer assessments due to the inaccuracy in marking; students may not take peer assessment duties seriously and may come up with contentious marks through prejudiced grading. Another issue is the fact that peer assessment is a relatively new method and hence causing students to resist the introduction of a new form of assessment.

**Conclusions**

WIL will more likely succeed if the institution/organisation is committed to student learning and with a view of employability. This means that the school/institute is fully engaged in the design, delivery and review of learning objectives. This should include clearly written objectives, practical workshop sessions where students get exposed to hands on learning. The institutions need to coach and mentally prepare working with industry since this will be a new role for many university staff and hence will mean working with a whole range of industry and community organisations of all sizes which are committed to student learning in varying degrees. To be able to maintain academic standards and ensure high quality learning outcomes for students in every placement are challenges and hence there is a need to maintain a clean balance between meeting the demands of industry and community and meeting the universities requirements for high quality learning.

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