Teaching and Assessment Strategies for Active Student Learning in University Horticultural Education

A. Hunter
School of Agriculture and Food Science
Agriculture and Food Science Centre
University College Dublin,
Belfield, Dublin 4, Ireland.

C. Elliott-Kingston
School of Biology and Environmental Science
Science Centre West
University College Dublin,
Belfield, Dublin 4, Ireland.

Abstract

Many of the goals of the university teacher today are to enthuse, drive and challenge students academically, intellectually and personally; to advance their capacity for critical thinking, judgement and communication; and to equip them with sufficient scientific and technical knowledge to make them competent horticultural practitioners. Given that most programme modules are delivered by lectures, there is general consensus that student learning is primarily passive. Similarly, module assessment tends to be summative. Thus, student-centred learning to foster an environment for active learning and encourage greater student class participation was introduced into a horticulture module (Nursery Production and Management HORT 40090). Similarly, formative assessment methods were also introduced. To this end, a segment of the above module relating to vegetative plant propagation was selected. The students were asked to work in self selected groups to thoroughly research the different aspects of the topic and to prepare a short PowerPoint slide presentation for delivery to the class. Additionally, they were required to peer assess each presentation and to agree a suitable grade with staff members in attendance. It is considered that the introduction of active learning and formative assessment to the module resulted in more meaningful learning for the students concerned and moved them higher up the student-centred learning curve towards more, responsibility and accountability. The concept is being gradually rolled out to other modules.

INTRODUCTION

In education, the efficacy of passive or surface learning methods has been questioned (O'Neill and McMahon, 2005). In passive learning, the primary focus of information transmission to students is via the teacher (Boyer, 1990; Harden and Crosby, 2000). Students sit in a classroom, absorb information mentally, passively transcribe notes or download lectures electronically and memorise them for regurgitation at examination. They are not required to actively participate in the class. Martinez-Pons (2001) described this as the banking concept where education is deposited by the teacher. Chickering and Gamson (1987) suggested that students do not learn much from this form of knowledge transfer and suggested its effect is at best temporary. It has its origins in Pavlov's conditioning experiments with dogs and argues that one can bring about behavioural change in animals as well as people as a result of imposing pre determined stimuli. It reflects the behaviourist learning strategies enunciated by Watson, Pavlov and Skinner.

Today, there is movement away from passive to active or student centred learning. Studies using active learning strategies have been undertaken in different learning situations, (Suwondo and Wulandri, 2013; Thaman et al., 2013). Active learning transfers learning responsibility from the teacher to the student. The concept of active learning has perhaps gained greater recognition following Piaget's studies. Young and Maxwell (2007) dealt with the transition from passive learning to cognitive constructivism and educed the influence of Dewey, Piaget and Vygotsky on its development. They raised the critical question: "if learning is a constructive process what does this mean for effective teaching practices?"

There are several definitions of active or student centred learning in the literature (O'Neill and McMahon, 2005). One possible definition is "a process whereby learners engage in a course of action in which they can explore possibilities for gathering information, asking questions, listening to answers, formulating ideas and reflecting on them" This definition draws on others such as provided by Gibbs (1995); Young and Maxwell (2007); Thaman et al. (2013). Thus, it is a learning environment where students are actively engaged in reading, writing, discussion, problem solving and other meaningful activities (Bonwell and Eison, 1991) to ascertain the meaning of an experience or theory (Carlile and Jordan, 2005). Boyer (1990) stated "the work of the professor becomes consequential only as it is understood by others". Higgs and McCarthy (2008) suggested that academic teachers take on the role of learning facilitators. Carlile and Jordan (2005) argued that a function of the teacher is to provide scaffolding to the students while Young and Maxwell (2007) suggested the teacher becomes a guide.

According to Ramsden (2003) the aim of teaching is "to make student learning possible". Chickering and Gamson (1987) published seven principles for good practice in undergraduate education – "encourage student-faculty contact, encourage cooperation among students, promote active learning, give prompt feedback, have high expectations and respect diverse talents and ways of learning". Boyer (1990) described four separate areas of teaching scholarship – "discovery or research; making trans discipline connections; the application and use of new knowledge and teaching which both transmits information and educates to produce new scholars. Kreber (2002) reviewed teaching under teaching excellence, teaching expertise and the scholarship of teaching. Ramsden (2003) described six principles for effective teaching namely, "interest and explanation, concern and respect for students and student learning, appropriate assessment and feedback, clear goals and intellectual challenge, independence, control and engagement and learning from students".

It is generally accepted that different students learn differently. Hawk and Shah (2007) reviewed five different learning styles. Given, that one style of teaching does not accommodate the learning requirements of each student; it is desirable to utilize a variety of styles. Kolb (1984) discussed three experiential learning models - Lewinian, Dewey's and Piaget's in addition to developing his own. Fleming (2001) developed the VARK or visual, auditory, reading/writing and kinaesthetic model. Honey and Mumford (1996) used the terms "activist, theorist, pragmatist and reflective". Gardner's model is based on intelligence represented as verbal/linguist; logical/mathematical, musical/rhythmic, bodily/kinaesthetic, visual/spatial, interpersonal and intrapersonal (Gardner, (1999). Carlile and Jordan (2005) elicited the implications of constructivism for teaching practice, four of which are: "build on what is already known, encourage active discovery and independent learning, give timely feedback and align objectives, strategies and assessment".

The primary principle underlying active learning is that students learn best when they actively construct their own knowledge (Kember, 1997). There are many strategies that can be used to encourage this such as individual and group projects, mind maps, brainstorming and short classroom assessments amongst others (Jennings, 2013b; Thaman et al., 2013). The learning pyramid is another method [(NTL) Institute for Applied Behavioural Science, 300N, Lee Street, Suite 300, Alexandria VA 22314]. Therefore, any activity that encourages team working, discussion, study group formation, demonstrations and learning by doing promotes critical thinking and learning (George and Sri Gayathridevi, 2013). However, critical thinking may not happen without the need for specific prompts such as outlined in Bloom's revised taxonomy of cognitive processes (Anderson and Krathwohl, 2001).

Active learning also includes assessment to help determine the level of learning attained. Crisp (2012) suggests that its primary function is to enhance learning. Other reasons are to summarise learning achievement, monitor learning progress, identify students' learning attributes and encourage further learning and to assign a numerical grade. Crisp (2012) outlined four different methods of assessment – diagnostic, formative, summative and integrative. Of these, summative and formative methods are the most widely used. Summative assessment is a summation of marks from the different components of assessment and its primary function is student grading, not student learning (Crooks, 1988). Formative assessment or assessment for learning is information communicated to the learner and is designed to improve student learning (Shute, 2008). Harlen and James (1997) stated that formative assessment is both criterion referenced since it relates to student learning in terms of skills and competencies and ipsative in as much as it considers student work, effort and progress over time. Opportunities for this type of assessment continue to assume an ever increasing role (Brown, 2004). This development parallels a shift in emphasis away from individual learning towards group and collaborative forms with the emphasis directed to what students will learn as opposed to what they have to learn (Jennings et al., 2013). This type of learning is associated with regular feedback. Gibbs and Simpson (2004) outlined ten conditions associated with feedback. Perhaps the most salient of these are that it is provided regularly, is informative on how students are progressing; indicative to highlight areas requiring improvement and focuses on student learning performance. They argued that, it should be given while still relevant to give sufficient time for students to utilise before they have moved on to another topic. Juhah et al (2004) listed seven principles for good feedback namely: "facilitate reflection in learning; encourage teacher and peer dialogue; clarify goals, criteria and standards; close the gap between current and desired performance; deliver high information to students about their learning; encourage self esteem and provide information to teachers that can be used to shape teaching". There are several methods of giving formative feedback. Shute (2008) produced formative feedback guidelines to enhance learning. She documented these as things to do, things to avoid and timing issues. It is essential that the assessment strategies adopted are valid and reliable; valid in so far that the assessment appraises exactly what is required and reliable so that it is always consistent and fair (Race, 2007).

Self assessment as proposed by Boud and Falchikov (2006) allows students to assess their own learning against set standards or prompts to indicate knowledge gaps. Jennings et al. (2013) documented several prompts that can be used in self assessment. It should encourage corrective action and enhance effective student learning. Peer assessment is also used to assess student learning. In it, students mark each other's work

anonymously, against set/specific criteria and possibly model answers or worked problems (Carroll, 1994).

As early as 1969 McNeill (in Black and Wiliam, 1998) reported that one of the key elements in Bloom's learning is that student effort is increased when small groups of students meet to discuss both their results and the difficulties they encountered in tests. Gokhale (1995) reported that the active exchange of ideas between students promoted critical thinking while Thaman et al. (2013) reported increased interest and understanding about a subject. Black and Wiliam (1998) suggested that it is the nature of the interactions "between teachers and students and of students with one another" that are important.

All my teaching modules have been designed to engage and challenge students at all stages during their academic career at University College Dublin. I use both behaviourist and constructivist teaching methods and include lectures, laboratory practical's, field trips, student presentations and research project work. I endeavour to propagate new ideas, foster active and reflective learning and to develop their capacity for critical thinking, judgement and communication. At the end of each academic year, I reflect on each module that I teach or have responsibility for and seek to relate my experience to recent literature and thinking on teaching and learning. I also make changes to the marks' allocation to the different elements of assessment. Arising from this, I formed the view that their learning experience in one of my modules [Nursery Production and Management (HORT 40090)] was insufficiently deep and perhaps lacked sufficient active learning experience.

MATERIALS AND METHODS

Student learning in this module was assessed using a combination of assessment techniques, namely, two continuous assessment examinations, individual field trip reports (not graded) and a final end of semester written examination. Students always received feedback on their continuous assessment examinations. The following changes to module delivery and assessment were made. Active learning within the module was increased by re appraising the curriculum content. The element of the curriculum dealing with vegetative plant propagation was selected. The class was randomly divided into five groups of two students. Each group selected a different aspect of propagation and the members were required to work together to research it over a period of four weeks. They were required to prepare a PowerPoint slide presentation containing 12-15 slides for delivery to the class. The students were given the objectives of the exercise and some reading materials. In addition, they were required to extend their literature search through scientific research publications. Each group was required to make a formal presentation to the class on an appointed date and were also required to peer assess each presentation. Additionally, academic staff members in attendance also assessed the presentations from a pre determined rubric. At the end of the five presentations a comprehensive discussion took place between the academic staff and the students, after which an agreed mark was awarded for each group presentation. This discussion also included feedback on their efforts and feed forward to enhance future learning. Changes were also made to the in class continuous assessments. Precise marks awarded for each question was documented on the question paper to facilitate self correction in class under the stewardship of the lecturer. During the correction process feed forward was given. The class was brought on a field trip to a nursery specialising in container and field production. The primary function of the trip was to relate their classroom learning to a range of day to day nursery issues. The class was asked to reflect on the study trip as a group and to provide one

group report evaluating their learning experiences surrounding many aspects of the nursery enterprises. Marks' allocation was changed from 25% each for two continuous assessment exams and 50% for the final written exam to 20% each for the two continuous assessment exams, 20% for the in-class group presentations, 10% for the field trip report and 30% for the final written element. The questions asked on the latter were aligned with the module outcomes and contained verbs such as "analyse", "assess", "evaluate" "consider" and "suggest" to prompt critical thinking paralleling Bloom's taxonomy of cognitive processes (Anderson and Krathwohl, 2001). Written consent was sought and obtained from all the class participants for permission to refer to the class of 2013/2014 anonymously concerning the outcome of teaching and learning changes to the module reported in this paper.

RESULTS AND DISCUSSION

In general, the students questioned the concept of studying in groups. They raised the issue that people have different learning styles thus sub consciously verbalising the report of Honey and Mumford (1996), Fleming and Bauma (2006), Hawk and Shah (2007). They disclosed that while making the presentation was a team effort, the research undertaken was not necessarily the case. This contrasts with the findings of Gokhale (1995). This suggests that group formation should be randomised as suggested by Jennings (2013a) or that the minimum number in the group should be at least three. Some considered the team/group aspect difficult as partners were not very enthusiastic and were reluctant to meet for discussions. Some stated that they preferred to work alone. Despite this, they noted that presenting researched information and speaking in front of their peer's greatly enhanced learning, understanding and meaning both from their classmates' presentations and their own. They also suggested that the learning experience of researching a topic and having to prepare a PowerPoint presentation was a much more valuable learning experience than simply reading notes. This concurs with the ethos put forward by Bonwell and Eison (1991). Increased in-class interaction between students themselves and students and academic staff to ascertain the meaning or significance of an experience aligns with the report of Carlile and Jordan (2005). For many in the class, this was their first experience in preparing and delivering a PowerPoint presentation. They considered that being able to present and improve their communication skills was very important as it enhanced their confidence. Although, some found speaking in front of the class difficult, they welcomed the opportunity. In agreement with Higgs and McCarthy (2008), the role of the lecturer changed from lecturing to learning facilitator by providing scaffolding as described by Carlile and Jordan (2005). The students reported that the exercise encouraged deeper learning and that their knowledge, interest and understanding of the subject area was greatly improved thereby reflecting some of the principles outlined by Chickering and Gamson (1987); Thaman et al. (2013).

The group report on the field trip was designed to prevent re gurgitation of facts; rather to encourage the students to reflect and brainstorm one another on their experience and on the reasons why various operations and management protocols were used paralleling the report of Jennings (2013b). For instance, they learned that tree lifting using a dedicated machine should not be viewed simply as the best method for harvesting trees; rather that it is a major investment and has major implications for tree quality. Similarly, they discovered the importance of using correct nomenclature; of faithfully preserving the phenotype; the potential of epigenetic variation, the significance of obtaining plant breeders rights and royalty collection for plants through the introduction of new plants.

These types of discovery concur with the findings of (George and Sri Gayathridevi, 2013). The group report was also intended to stimulate greater student interaction and the exchange of ideas so that they discussed and reflected on their individual learning experiences and shared them together to increase their understanding concurring with the findings of Gokhale (1995); Thaman et al. (2013).

In relation to the continuous assessments, the class found it very beneficial to self assess their own work. They also stated that they retained the information better. This finding concurs with the report of Kember (1997). They also found the immediate feedback/feedforward extremely beneficial and stated that it was best to analyse the answers immediately after an assignment was undertaken in comparison to receiving a mark at a later date. This response concurs with the work of Gibbs and Simpson (2004), Crisp (2012), Jennings et al. (2013) and also reflects the information espoused by Shute (2008). In agreement with Boud and Falchikov (2006), it allowed the students to assess their own learning against set standards and indicated knowledge gaps in their learning. Immediate feedback in relation to the module showed them the significance of terms such as "clone"; "clonal material"; "epigenesis", "genetic characteristics of vegetative propagation" and what this means for the progressive nurseryman. They disliked the concept of peer assessment even if it could be undertaken anonymously, contrasting with that reported (Carroll, 1994).

CONCLUSIONS
In this module, the relative ratio of active to passive learning has been adjusted to better reflect student learning, knowledge creation, learning experience and achievement. Furthermore, the greater use of formative assessment, which now accounts for 70% as opposed to 50% previously of assessment strategy coupled with timely feedback, is a major improvement. It aligns with the theory espoused by Brown (2004). I consider that the changes implemented have enhanced academic student interactions and transformed the lecture room environment into one where active learning occurs reflecting the work of Higgs and McCarthy (2008). The changes have also ensured that the concept of backwash as described by Biggs (1999) is minimised. The indications to date suggest that student performance has improved and better reflects higher order learning, long term learning and subsequent work performance and success compared to reliance on summative assessment. Judging by the positive student comments arising from the module changes, they considered that it was now a very interesting, enjoyable and beneficial module which enhanced their learning of the subject. I consider they fulfil many of the aspirations of teaching and learning enunciated by Gibbs and Simpson (2004); Juhah et al. (2004).

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