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Authors(s)	Elliott-Kingston, Caroline, Doyle, Owen P. E., Hunter, Alan
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Scenario-based Learning in University Horticultural Education

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

Owen P.E. Doyle and Alan Hunter
School of Agriculture and Food
Science
Agriculture and Food Science Centre
University College Dublin
Belfield, Dublin 4, Ireland

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Abstract

As an applied science, horticulture is particularly suited to interactive teaching and learning methods. Much of the undergraduate learning in horticulture is passive; therefore more active learning strategies should be introduced. One such active learning technique is scenario-based learning (SBL). This form of learning allows students to apply academic knowledge to a simulated 'real-life' situation. It is particularly suited to promoting group participation and learning. Its use provides students with the opportunity to recognise and solve problems, to think critically and to develop teamwork skills. Recently, an SBL project was introduced to the Fruit Production (HORT30190) undergraduate module at University College Dublin. In order to implement the project, the class was divided into groups and each group was required to establish a hypothetical commercial dessert, culinary or cider apple orchard in Ireland. The groups were required to consider site characteristics, growing and pruning systems, rootstocks, cultivars, pollinator selection and planting density. They presented their results in class using posters and submitted a personal learning journal associated with the project, both of which were assessed by staff. Student response to the SBL project was evaluated for benefits such as increased understanding of course material, acquisition of transferable skills and enjoyment of the learning method. This project is an example of formative assessment in action. Scenario-based learning allows students to contextualise learning while acquiring transferable skills. It is suitable for implementation in a wide range of diverse university modules.

INTRODUCTION

A number of educational theories currently exist. In order to understand how knowledge is acquired, and therefore how best to teach university undergraduates, it is important to understand how learning occurs. Each educational theory attempts to understand and analyse how students learn. Key learning theories include Behaviourism, Cognitivism, Constructivism, Social learning and Connectivism (e.g. Dewey, 1897; Watson, 1913; Skinner, 1938). These theories sit along the continuum from teacher-focused practices at one end to student-centred practices at the other. Two of these theories will be examined in this manuscript.

Behaviourism

Beginning in the early 19th century, and being teacher-focused, Behaviourism is placed at one end of the learning and teaching continuum. It is associated with the American psychologists John B. Watson and B. F. Skinner who observed human

behaviour (Watson, 1913; Skinner, 1938) and Edward Thorndike who studied animal behaviour (Thorndike, 1903). Behaviourism concentrates on observable behaviour and conditioning of the subject, its main tenet being that behaviour can be observed and measured and, through training, can be changed. Thus, the subject can be ‘conditioned’ (Pavlov, 2003). Behaviourist teaching methods rely on the expert teacher transmitting information to the passive student. This method of teaching has been described as the ‘transmission model of teaching’ whereby knowledge transmission by the teacher is active, and knowledge absorbance by the student is passive (Kolitch and Dean, 1999). From the point of view of the student however, the experience can be negative as the method is entirely teacher-focused with little learner activity (Martinez-Pons, 2001). Yet, Higgs and McCarthy (2005) state that no learning is totally passive as, by definition, learning is an active process. Nonetheless, today, knowledge dissemination from the lecturer to the student usually takes the form of PowerPoint lectures that students download from the intranet. It is not always an exciting, provoking or interactive experience for the student. Therefore, it is the lecturer’s duty to make lectures engaging and to make learning possible (Ramsden, 2003) by employing a variety of teaching methods to accommodate different learning styles, rather than relying on the traditional ‘chalk and talk’ method. Behaviourist teaching methods are still relevant today in certain situations, especially in the area of curriculum alignment where the use of behaviourist language to define learning outcomes makes clear to students exactly what is required of them in terms of assessment (Race, 2007; Jennings and McMahan, 2013). In addition, Behaviourism is valuable in the teaching and assessment of competencies.

Constructivism

Further along the continuum lies Constructivism, an alternative teaching theory to Behaviourism that is student-centred rather than teacher-centred, thus placing the student at the centre of learning. Constructivist theory recognises that each individual has a particular way of learning based on previous knowledge and experience and the learner integrates new knowledge with existing knowledge to construct new meaning (Carlile and Jordan, 2005). Thus, Constructivism helps learners to understand rather than just accumulate knowledge (Bonwell and Eison, 1991). The American philosopher, John Dewey, was one of the foremost proponents of Constructivism (Dewey, 1897). His motto “Education is life itself” explains why he was known as the Father of Experiential Learning. He was in favour of progressive education where students are actively involved in educational experiences that enable them to become responsible members of society. Whilst against authoritarian education, neither was he in favour of completely unstructured, student-driven learning. Instead he advocated that learning should consider students’ past experiences in order to provide new experiences that will benefit the individual and society. Jean Piaget, epistemologist, also believed that learning is an active process that occurs as a result of experience; the learner assimilates new knowledge with previous understanding, thus transforming knowledge (Piaget, 1936). The common thread in Constructivism is that the learner encounters new information through experiences, assimilates this information with previously held knowledge gained from earlier experiences, and constructs new meaning. Rather than just memorising facts, Constructivism enables understanding of knowledge. Ultimately, Constructivism is learning by action, rather than observation. A benefit of Constructivism is that active learning often involves peer interaction thus promoting social interaction and collaborative learning.

Student-centred learning

Constructivism is student-centred so active learning techniques are required in the lecture hall. The lecturer acts as a facilitator, helping students to 'construct' knowledge by solving problems, rather than teaching facts that must be memorised; the resulting 'constructs' have deeper meaning for the students. These constructs are transferable to other disciplines and are more likely to be remembered in the long term (Bringle and Hatcher, 1995). In student-centred learning, students must take responsibility for their own learning by becoming involved in the classroom activities (O'Neill and McMahon, 2005). Active learning techniques in student-centred teaching include problem-based learning (PBL), poster presentations, field trips and laboratory practicals (Barrett, 2005).

Scenario-based learning (SBL) requires students to take an active approach to learning through the use of realistic scenarios that contextualise learning (Donnelly and Fitzmaurice, 2005). Experiential learning occurs as the students apply both prior and new knowledge to solve challenges presented in the scenario (Kolb and Kolb, 2005), which is usually presented incomplete. In SBL projects, students recall pre-existing knowledge relevant to the given scenario, research 'missing knowledge', evaluate new knowledge with respect to the scenario, assimilate the new and pre-existing knowledge, and finally 'construct' new learning outcomes. Group-based SBL projects that replicate professional workplaces can be used to develop team skills. Each student can assume credible, work-oriented role(s) similar to those found in real-world employment (Errington, 2011). Completing the task "will ideally engage students in processes of problem-solving/setting, decision-making, acts of creativity, critical analysis, evaluation, and reflectivity - factors compatible with employability skills valued by employers" (Hare, 2001; Errington, 2011). Implementing experiential learning through SBL will only benefit students if the learning outcomes are relevant. Thus, it is important to choose an appropriate, realistic scenario and to clarify the learning outcomes associated with the project. Target questions to guide the scenario investigation should be communicated to students at the beginning of it (Jennings and McMahon, 2013). Not all aspects of the project need be prescribed; student autonomy can and should be allowed in some areas but these areas must be made clear. How students will report back on the completed task must also be clarified at the start of the project. Ultimately, SBL enables the theory taught in lectures to be allied with professional practice (Errington, 2005).

The purpose of introducing scenario-based learning (SBL) was to investigate whether an SBL project would improve the standard of horticultural education in undergraduates by providing conditions that enhance personal responsibility for learning and allow students to acquire transferable skills for employment, such as the ability to objectively analyse and evaluate situations, and to be self-motivated and independent yet able to work effectively within a team. Ultimately, the purpose was to produce graduates who are better equipped for the horticulture industry. The specific goal of this project in UCD was for students to construct the knowledge required to achieve learning outcomes associated with a module Food Production: Fruit (HORT30190) through an SBL poster-based project by assimilating pre-existing knowledge acquired during formal lectures, fieldwork, practicals and recommended reading, with new knowledge acquired during individual and group research.

As university modules are outcomes-based, the learning outcomes listed in the module descriptor describe what the student should be able to do at the end of the module, rather than what the lecturer should teach during the module; therefore, student activity

must match the learning outcomes. From these outcomes, the assessment criteria are developed. Activities that enable students to meet the assessment criteria, and hence the learning outcomes of the module, are then organised (Race, 2007). It is envisaged that five of the learning outcomes of HORT30190 will be met through completion of the SBL poster project, including: plant physiological background to growing commercial fruit crops; how roots/shoots grow; how flowering and fruiting are controlled and interact; development of practical management skills; and measurement of quality in fruits. The remaining outcomes will be achieved through formal lectures and fieldwork practicals.

MATERIALS AND METHODS

In week four of a twelve week semester, the concept of scenario-based learning was introduced to the students. The chosen 'real life' scenario involved the successful establishment of a commercial apple orchard from establishment to harvesting of the first crop. The class of ten students was randomly divided into three groups. Task completion required the production of a group poster and an individual learning journal. Each group was free to choose the location of the orchard within Ireland and the type of orchard (culinary, dessert or cider) to be established. Choosing different locations in Ireland presented particular issues e.g. aspect, soil, topography, precipitation amount etc. Deciding whether the orchard was for cider, culinary or dessert apple production also raised particular challenges e.g. different training and pruning methods, rootstock and cultivar selection had to be considered. The groups were free to decide whether each member would be responsible for a different aspect of the project or whether they would share certain tasks. Each group was required to prepare a poster and present their results orally within a 15-minute time period to the class, academic staff and technical staff. This was followed by 10 minutes question/discussion time. Questions could be posed by both staff and peers. In addition, each student was required to produce a personal learning journal recording his/her involvement in the project, elaborating on the areas to which he/she particularly contributed. The learning journal was to include details of scientific papers read, websites visited, conversations with pomology professionals, result of soil analysis tests undertaken, and potential funding for business start-up. The students were specifically asked to include their views on the use of an SBL project in horticultural education e.g. whether they enjoyed it or not, whether they felt it benefitted their learning and knowledge of the subject in any way, including preparation for the end of semester examination, and also suggestions as to how the project could be improved in the future. They were deliberately not provided with structured evaluation forms so as not to direct their feedback in any particular direction; instead they were free to respond in their own words. It was intended that they would also gain 'added-value' from the module by acquiring transferable skills, including poster preparation, PowerPoint techniques for poster assembly, independent research skills and team collaboration skills.

Grading for the SBL project was integrated into the module marks as follows:

- | | |
|--|-----|
| 1. SBL Poster | 20% |
| 2. SBL Learning journal | 10% |
| 3. Fieldwork practicals | 40% |
| 4. End of semester written examination | 30% |

RESULTS AND DISCUSSION

Posters

Three posters were produced: group 1 chose to describe the establishment of an organic dessert and culinary orchard; group 2 the establishment of a conventional, non-organic dessert orchard; and group 3 formulated a proposal to set up a cider orchard and a school to teach cider/apple juice production.

The posters were graded under three headings: poster content, visual quality of poster and verbal presentation of poster. While these parameters were important, they did not represent the true goals of the SBL project which were:

- 1) to promote collaboration between the students
- 2) to prepare them for future teamwork in employment or further study
- 3) to facilitate acquisition of new transferable skills
- 4) to assist students in preparing for the end of semester examination
- 5) to encourage personal responsibility for their own learning

Personal learning journal

Each student recorded on-going progress. Examples of comments from four different students' journals:

22 October "Went to local supermarket to see what cultivars were in stock and how much each apple or bag of apples cost"

29 October "I started practising with PowerPoint to get the sizing and background for the poster"

07 November "I wrote up my part of the poster (Introduction and Establishment). I also came up with the poster title"

Undated "Windfalls can be picked off the ground for cider. But what about pathogens? Some are carcinogenic. Will these get into the juice?"

Poster project feedback

Students were asked to include feedback in their learning journals. 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. Without exception, the students indicated in their feedback that they found the SBL poster project interesting, useful and enjoyable. None had ever used project-based learning before. None had ever produced a poster before. Below are comments from four of the students:

"I felt making a poster was a beneficial experience. It was not an activity I had done to date and was much harder than making a presentation as you need to get a lot of info with minimal words plus pictures. It will be a valuable skill for the future in terms of careers. It allowed me to bring together all the information I have learnt in this module's lectures, practicals and field trips plus previous year's pomology (Stage II) and organic agriculture (Stage III) modules, plus my work experience. Integrating info gives a sense of purpose to my studies. Plus, I felt it will be of benefit to me for revising for my exam. Presenting the poster was one of the most challenging aspects for me but it did help develop my confidence and public speaking skills. In all, I did enjoy the task and feel I have learnt a lot. I would recommend it as a project for future students. On reflection, the poster exercise is probably the assignment I have learnt from most this semester in terms of academic knowledge and life skills, so thank you for the opportunity" *Student S.N.*

"I enjoyed doing the poster as we have never had the experience before. It was difficult to find times that suited all of our team. So when we met up, we would say everything that we have been researching and gave each other ideas on how to expand on

what we already had. Having other people's input into research was nice as others have different ideas to bring forward. Learning how to do the poster was difficult but interesting and fun. Combining our information on the poster was the most difficult task; we all had so much prepared and felt the poster wasn't long enough for all our details. I feel like I learnt a lot from doing the poster. I generally find I learn more from doing things myself, more so than from lectures. Having to find my own information was worthwhile and taught me a lot". *Student S.D.*

"The poster was a great idea, I learned a lot of new talents including working with people, the use of PowerPoint for a poster, and of course the presentation. I found the presentation very hard to speak in public but very rewarding also in the way you learn so much from doing your own research. The putting of slides together gives you a really good understanding of the chosen topic". *Student R.B.*

"The most interesting skill I learnt both in this module and in this semester in total was how to design a poster using Microsoft PowerPoint. This is skill which I know will benefit me greatly in the future as I have ambitions of expanding my own business. The research and development which I put into the poster also taught me in great detail about the steps involved in establishing an orchard. The fact that it was a group presentation is also an excellent way of learning as I feel my communication and leadership skills are also further developed. The poster designing allowed me to form closer relationships with my classmates and we worked very well as a team, which further strengthened our friendships. The actual presenting of the poster was also an excellent experience as it is often a weekly if not daily requirement by employers to have employees make presentations in modern workplaces. This skill will therefore be of great benefit to us in future careers". *Student K.McC.*

CONCLUSIONS

Certain theories of education better suit those delivering academic courses, such as universities, whilst other theories of education better suit the learner. Methods of teaching associated with Behaviourism are ideally suited to deliver course material because the methods employed, e.g. PowerPoint lectures, allow the delivery of a large amount of information in a short space of time. Alternatively, methods associated with Constructivism suit the learner better because rather than passively listening in class, the student can actively learn by doing, thus constructing knowledge for himself/herself, with the lecturer acting as facilitator. Scenario-based learning (SBL) allows students to apply to a simulated 'real-life' situation the academic and practical knowledge gained from the taught component of a horticulture module, supplemented by individual and team research that results in new knowledge, thus promoting self-learning and enhancing team collaboration.

However, there are some caveats to introducing more student-centred learning in universities. Allowing students the time to learn rather than just listen passively is a slower process but ultimately the student will better understand and remember the learning material. However, this creates a dilemma for the university lecturer because Constructivist methods of teaching and learning do not allow the same amount of course material to be covered within the allotted lecture time. This means that learning outcomes must be adjusted to take account of less material covered, or students must be required to cover more of the lecture material themselves outside of formal lecture times. The introduction of novel teaching approaches, such as SBL, to deliver required learning outcomes will enrich students' educational experience. The adoption of such student-

centred methods will improve traditional university degree programmes in horticultural education, which are currently primarily based on teacher-focused methods.

Scenario-based learning has been shown to improve undergraduate learning, based on student feedback in the learning journal and examination grades. As an active learning method, it transfers learning responsibility from the teacher to the student and facilitates diverse learning styles. We are currently expanding the use of SBL to other horticulture modules within the School of Agriculture and Food Science at University College Dublin.

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