The Name Game for New Players©

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Knowledge of plants, their names, botanical features, and growing conditions, can be taught in an holistic manner that combines the positive aspects of "training on the job" with the advantages offered by the learning environment of a tertiary institution. Such education can contribute in a wider sense to the future of the horticultural industry by adopting a teaching approach that encourages creative thinking. Ways in which courses in plant knowledge and plant naming can cater to individuals with various learning styles, and the process by which they can incorporate tasks that enhance creative thinking abilities of students, are described using as an example a course entitled "Plants in the Landscape", developed at Massey University, New Zealand.

INTRODUCTION

Few would dispute the importance for new entrants in the horticultural industry to have a sound knowledge of plants and their names. Lack of such knowledge and understanding will inevitably result in loss of productivity and efficiency to a degree that varies with the type of horticultural enterprise. Whilst training "on the job" has many educational advantages, the initial contributions of new employees to the enterprise, and to horticulture in general, will be less than optimal until this gap in their knowledge has been filled.

New staff members generally find themselves confronted with a multitude of challenges that require further learning. Because they are usually unable to address all such issues simultaneously, many tend to focus on coming to grips with tasks that have a direct impact on productivity.

To reduce the initial lag time, an obvious solution is to employ people who are well trained and equipped for the job. In terms of plant knowledge this would be an option if it were possible to teach people to play the "name game" in a way that is based on the advantages of "on the job training". The success of the latter is rooted in that most people learn best when they are actively involved with the subject matter. Active involvement, such as experiencing and working with plants, requires people to use and develop observational and practical skills, whilst in most cases communication skills are also drawn upon. In other words, "training on the job" works well when measured in learning outcomes because it naturally caters for three main learning styles; visual (seeing), kinesthetic (doing), and auditory (hearing).

Just as successful businesses depend on their ability to cater to the different lifestyles of their clients and to the work styles of their employees, education is only efficient when it caters to the different learning styles of students. Research on learning styles of secondary school students revealed less than a third of all students remember 75% of what they hear during a normal lesson, and 40 percent retain 75% of what they see or read. Fifteen percent are kinesthetic learners, i.e., they learn best by doing. Experience, which includes seeing, hearing, and doing among others, accounts for 80% of what people learn (Dryden and Vos, 1997).

To formally train people in plant knowledge, from scientific names, botanical features, to optimal growing conditions for plants, presents a challenge to the educator in that the subject material without the context presented by an actual horticultural enterprise, could easily erode people's passion for its principle component, plants. In response to the obvious need in the horticultural industry for employees with plant knowledge, a course in plant knowledge, entitled "Plants in the Landscape", was designed at Massey University, New Zealand. It successfully addresses the challenge of presenting students with opportunities for learning from experience without drawing on the professional context of the subject matter.

Since its introduction, yearly student enrollment numbers have been consistently high and the course has attracted much interest from the wider community. Student evaluations clearly underscore the perceived value and quality of this course both in terms of its contribution to students' overall plant-oriented education, as well as a stand-alone, elective component of programmes that are not directly related to horticulture and landscape management.

The course design illustrates how to most effectively tap into the learning potential of students and how to provide a learning environment that enables people to confidently apply their knowledge and understanding. By encouraging a self-directed learning style, the course contributes to the fulfillment of a more generic need resulting from changes in our society; the need for students to emerge as self-acting, self-confident, and creative managers of their own future.

The principles of course design and teaching approach described here, with special reference to the course "Plants in the Landscape", can be applied to any situation where information sharing is required for the purpose of learning. They are of particular relevance to employers in the horticultural industry, who are at least partially responsible for teaching their employees to teach themselves.

LEARNING OUTCOMES

The development of training material is initially guided by the required learning outcomes that are directly related to the subject matter. "Plants in the Landscape", a practical and systematic study of plants in the landscape with emphasis on recognition, identification, description, and use, was designed to achieve learning outcomes based on the following objectives:

- To develop knowledge and skills in plant recognition and identification;
- To stimulate an appreciation for ornamental plants, their cultural requirements, and their use in the landscape;
- To further observation skills and the ability to transfer observations to botanically accurate descriptions and drawings;
- To understand botanical plant descriptions in the literature.

As is evident from the introduction, the course design and development also address a number of issues not directly related to the subject matter, but nevertheless representing learning outcomes that are important contributors to the overall education and preparation of new entrants in the horticultural industry. These learning outcomes can be summarised as follows:

- To encourage a self-directed approach to learning;
- To equip students with the tools that will enable and encourage them to continue to teach themselves, with or without the support of an educational institution;

- To encourage students to involve both right- and left-brain hemispheres in the learning process;
- To stimulate the development of observational and visualisation skills.

The latter two learning outcomes are related to each other, and justify further explanation. In view of future, professional demands on today's students' abilities to think creatively and integrate their skills and understanding, an holistic approach to teaching is required that extends the learning outcomes beyond the knowledge and analysis stage, but emphasises a synthesis of concepts presented into new ideas. To create new concepts one needs to be able to link together information from different parts of the brain. It is well accepted that both sides of the brain process information in different ways. Traditionally, the schooling system has almost exclusively focused on left-brain learning and thinking. Whilst the left hemisphere of the brain is specialised in logic, words, mathematics and sequence, the right hemisphere is better equipped to help us understand concepts, pictures, recognise patterns and relationships, and to create. Neither is more important than the other, but when used together, the synergy can lead to the most creative discoveries, and the deepest understanding. Increasingly, this becomes one of the most important attributes of potential employees.

Observation and visualisation are the domain of the right hemisphere of the brain. "Perceptual skills, like verbal skills, are valuable because they improve thinking" (Edwards, 1995; p.40). Right-mode information processing is visual, spatial, and relational. The right half of the brain enables an observer to perceive things the way they are. When relying on the left mode, perception is influenced by what the observer expects to see. Being able to perceive the true nature of objects and concepts forms the basis for another process, governed mainly by the right hemisphere of the brain, that of creative thinking. Creativity involves the ability to generate new ideas and new concepts. It is always the result of challenging the status quo; of re-arranging, applying, and combining existing elements in a different way (Dryden, 1978). Creativity is where the great inventions and ideas in life come from (Dryden and Vos, 1997). Techniques to "teach the whole brain", whilst available, still give way in most cases to the traditional approach that emphasises and rewards left-brain skills, even though the former are in many ways the key to the future (Edwards, 2001; Dryden and Vos, 1997).

TEACHING APPROACH

The course content of Plants in the Landscape is contained in four workbooks and a plant portfolio guide. Each workbook contains three topics. A topic consists of information and revision questions relating to a specific theme, a description of one or more plant families, and a set of information cards that describe members of a particular group of plants. Themes range from nomenclature, classification, and the use of keys to botanical features, plant types, and the suitability of plants for specific growing conditions. In total, more than 20 plant families are discussed in detail, and each family outline is followed by brief descriptions and illustrations of New Zealand native plant members where applicable. On the information cards, individual plant species are described, including their scientific name, family name, origin, plant type, botanical features, their use in the landscape, and preferred growing conditions. The set of information cards included in each topic relates

to the theme of that same topic. For example, the theme covering the botanical features of fruits is followed by a set of information cards for plants grown primarily for their ornamental fruit. Each topic thus provides students with material in a number of different sections that relate to, illustrate, or otherwise support each other. Topics themselves are arranged in a logical order, with each one building on the knowledge contained in the preceding topic(s).

The course material is designed to encourage a self-directed learning approach by entering into a dialogue with the student, requiring them to take responsibility for their own learning, offering them freedom of choice in a number of topic areas, and providing opportunities for self-assessment.

Throughout the course, each of the three main learning styles, visual, auditory and kinesthetic, is addressed. Students are presented with a variety of visual material. Each plant species described on the information cards of the workbooks is illustrated with a line drawing, and throughout the workbooks, illustrations are used to cater to visual learners. Tutorials using slide-shows to revise material are offered to students prior to their exam. For internal students, weekly field-walks on the campus grounds are organised, so that all plant species, belonging to a particular topic of the workbook, can be observed by the students in a natural, garden situation. Samples of these species are taken back to the classroom where a display is set up. Students are then required to create their own illustrations by producing a botanically correct drawing of each sample. Students are also expected to complete a personal portfolio of a specified number of plants for which they have a particular interest. Each plant in this portfolio is to be illustrated with a photograph that shows important botanical features.

Auditory learning styles are accommodated for with tutorials and weekly lectures that explain and discuss the themes of each topic, and with the field-walks during which commentaries are given on plant species in the campus garden.

Kinesthetic learners are the most difficult to design a suitable teaching approach for, given the subject matter and the learning environment. Hands-on experience with a wide range of plants for the purpose of a course that should teach plant names and related plant knowledge is a practical impossibility in a learning institution that offers a multitude of courses in a variety of subjects. In an earlier version of Plants in the Landscape, one without formal field-walks, students were given a map of the campus garden with directions to each plant species belonging to a particular topic. They were required to answer questions about the plants that could only be answered correctly if they had located the correct plants. In the same version, students were also expected to set up and look after each weekly plant display, but this proved unsatisfactory due to the logistics of students organising their time around the keeping quality of the display plants. Currently, the plant display is taken care of for them, so students can concentrate on completing the drawings for each sample. Working with information about plants, researching botanical literature, and drawing plants in particular, now constitute the main kinesthetic-oriented tasks.

The requirement of creating drawings of plants serves other objectives as well, those of fostering observation skills and of encouraging right-brain activity in general. The ability to draw appears to depend on whether one is able to access the right-hemisphere qualities whilst "turning off" the left hemisphere. To draw well, that is, to draw things as they are, one must learn to perceive well. The right half

of the brain processes information so that it can be represented accurately in visual form (Edwards, 1995, 2001). The left brain on the other hand, processes visual information in a way that interferes with the ability to perceive the actual proportional relationships, features, and qualities of elements. An example of the result of such misperception is the "chopped-off-skull-error", Edwards' term for a common problem in beginning students in her drawing courses (Edwards, 2001). Many people, when asked to complete the lower part of a face in profile, will draw the rest of this person as if part of the skull was chopped off. Few would draw the head with realistic proportions, that is, in such a way that the length between eye level and the crown of the head is equal to the distance from eye level to the chin, and to the distance between the back of the eye and the back of the ear. The left-brain hemisphere tends to interfere by enlarging elements that dominate the impression of a human head, the facial features. The more complex an image, the more likely one is to engage in right-brain observation. Drawing upside down images is a good way to practice the shift from left to right brain information processing. The left hemisphere of the brain turns off when it is presented with tasks that involve observation of patterns, proportions, angles, and the like. Producing drawings of plants that accurately represent their botanical features is impossible without engaging the right half of the brain. The principles underlying the art of botanical illustration are based on observation skills that involve the perception of the actual proportional relationships between the various plant features, such as the length of a petiole compared to the leaf length, the arrangement of the leaves along the stem, and the relative sizes and shapes of flowers and leaves. Since plant identification hinges on visual differences between individual plant species, having to focus on features that make up the outer appearance of plants further strengthens students' understanding of botanical classification. As such, the task of drawing plants turns the course into an holistic learning experience and enables students to achieve objectives beyond those directly associated with the subject matter. Edwards advocates the idea of a school system that teaches the whole brain and suggests that "such a system will surely include training in drawing skills — an efficient, effective way to teach thinking strategies suited to the right brain" (Edwards, 2001; p.41).

CONCLUDING COMMENTS

The advantages of learning plant names and acquiring plant knowledge whilst working in an horticultural enterprise can clearly be achieved within the framework of a formal course offered by a tertiary institution. In addition, the design of such courses offers the opportunity to set the scene for an optimal learning experience, catering to individuals with various types of learning styles, and incorporating tasks and activities that stimulate both left- and right-brain involvement. Learning to engage the right hemisphere of the brain when required is regarded as one of the essential prerequisites for developing and enhancing creative-thinking abilities (Edwards, 1995). The introduction of right-brain tasks in a course that deals with primarily left-brain oriented topics, contributes to the preparation of students for a future that largely depends on generating and applying new ideas.

The value to the horticultural industry of teaching the "name game" to new players, thus extends beyond simply conveying the rules of the game to include learning objectives that relate to the overall education of up-coming contributors to the industry.

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Scheduling Flowering in *Metrosideros excelsa* (pohutukawa)©

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INTRODUCTION

We have been working on a number of plants native to New Zealand to bring our knowledge to a stage at which some of them could be of use in the floricultural industry, either as cut flowers or flowering pot plants. Candidates receiving the greatest attention to date have been members of the Pacific genus *Metrosideros*, especially the New Zealand Christmas tree or pohutukawa (*M. excelsa*), and the colourful native legumes *Sophora* (kowhai) and *Clianthus* (kowhai ngutukaka or kaka beak). More recently, flowering in *Phormium* (flax) has been studied, and we are extending our findings in *Metrosideros* to plants in the closely related *Eucalyptus* group.

There are three parts to our research on pohutukawa: overcoming juvenility in micropropagated plants (i.e., making the plants become competent to flower as soon as possible), understanding the environmental signals that trigger flowering, and working out the conditions needed to control the timing of flowering and the effects on flower quality (Clemens et al., 2002). Working on overcoming juvenility has led to a theoretical breakthrough that could have far-reaching implications to the way we prune and train trees (Sismilich et al., 2003a, b). However, here we want to briefly review the results for controlling the triggers for flowering, and the accelerating and braking of floral development so that quality blooms can be produced to a set schedule.

RESULTS AND DISCUSSION

We showed that pohutukawa is a facultative short day plant: plants kept in long days initiated few flowers, whereas those in short days flowered as if they had been allowed to go through the naturally shortening days of autumn. Plants also needed to be cooled for flowers to form properly (Henriod et al., 2000). To refine these effects, we studied the effect of irradiance (the quantity of photosynthetically active light) during floral induction on flowering. Most people have found that the more light a flower crop is given during the early stages of floral development, the more flowers are produced. However, this was not the case in our experiments with pohutukawa. Although increasing light did increase flower number up to a certain, optimum level (~550 $\mu E \cdot m^{-2} \cdot s^{-1}$), flowering became worse under higher light conditions (Henriod et al., 2003). Plants flowered poorly under low light (~200 $\mu E \cdot m^{-2} \cdot s^{-1}$) (Fig. 1). All plants had been transferred to a forcing greenhouse for evaluation after 10 weeks induction treatment, so these effects were caused at or before microscopic flower buds had formed.