

# Three's a crowd: The 1R of replacement for education and training

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## Abstract

The ideal 'replacement alternative' is defined within the 3Rs philosophy of Russell and Burch (1959) as 'non-animal'. However, the nature of knowledge and skills acquisition within the life sciences highlight a shortcoming of the 3Rs approach for education and training. Despite the widespread success of replacement of harmful animal use by non-animal alternatives such as multimedia, virtual reality, training mannequins and simulators, they may not be sufficient for full knowledge and skills acquisition in all courses. Specifically, some students and professionals should work with animals, animal tissue and clinical procedures. There is widespread evidence of the ability to meet such teaching objectives in ways that are neutral or beneficial to individual animals and that do not involve animal experimentation or killing. The use of ethically sourced animal cadavers for dissection and skills training, and apprenticeship into clinical practice with animal patients, are examples. Along with non-animal methods, such approaches are also ideal replacement alternatives. Furthermore, successful replacement has been achieved within all life science courses. Policy and practice should therefore move beyond the 3Rs. It is argued that the 1R of replacement, when broadened from its non-animal focus, is sufficient to ensure ethical and effective acquisition of knowledge and skills in life science education and training.

**Keywords:** replacement, 3Rs, alternatives, education, training

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## Introduction

The ideal 'replacement alternative' is defined within the 3Rs philosophy (Russell and Burch, 1959) as 'non-animal'. There has been widespread success in education and training with replacement of harmful animal use by non-animal alternatives such as multimedia, virtual reality (VR), training mannequins and simulators. Such non-animal approaches have brought pedagogical, ethical and economic advantages within many practical classes.

## Knowledge and skills acquisition: Shortcomings of the 3Rs

Most interaction with animals in the life sciences comprises harmful animal use - specifically animal experimentation and the killing of animals. Non-animal approaches may not, however, be sufficient for meeting all teaching objectives in the practical classes of some disciplines. The nature of knowledge and skills acquisition within the life sciences highlights a shortcoming of the 3Rs approach with respect to education and training because veterinary and zoology students must work with animals,

animal tissue and clinical procedures as part of their education and training. Such interaction with animals is necessary at this level because some essential knowledge and skills can only be gained through hands-on experience. Similarly, training at the professional level may require direct experience with animals.

## Redefining replacement for education and training

There is widespread evidence of the ability to meet teaching objectives that involve animals and animal tissue in ways that are beneficial or neutral to individual animals and that do not involve animal experimentation or killing. Beneficial or neutral interaction with animals, such as the use of ethically sourced animal cadavers for dissection and skills training, and apprenticeship into clinical practice with animal patients, are examples. The InterNICHE Policy on the Use of Animals and Alternatives in Education (Jukes and Chiuia, 2003) provides definitions and guidelines concerning these issues. Along with non-animal methods, such approaches are also ideal replacement alternatives, necessitating a

redefinition of replacement for education and training.

Indeed, those working with animals in the professions, are increasingly expected to have high ethical standards. For example, veterinarians are expected to care for animals and to be literate in animal welfare. Similarly, zoologists are expected to be aware of the possible negative influence of their activity on animals and ecosystems and to adjust their approaches, for example in the field, to remove or minimise such influences. It follows that this increased demand for awareness and ethical practice should be reflected in education and training.

Beneficial or neutral interaction with animals can therefore be seen as a replacement approach in education and training, whilst also ensuring better preparation for the professions. Moreover, this approach illustrates the fallacy of conventional binary thinking that presents only a choice between harmful interaction with animals or no interaction at all. For example, the fallacy that if animals are necessary for surgical skills acquisition then animal experiments provide the only option. This also illustrates the confusion between *method* and *aims*, particularly the attachment to a specific method (animal experimentation, and practical classes using this approach) rather than a primary commitment to effective acquisition of knowledge and skills.

### **Practical viability and impact of full replacement**

The practical viability of teaching approaches that involve only beneficial or neutral interaction with animals rather than harmful animal use is demonstrated by the many examples of universities that have established sustainable and fully humane practical classes (Jukes and Chiuia, 2003). For example, existing body donation programs can and do provide ethically sourced animal cadavers and tissue from both small and large animals, by linking departments with teaching hospitals and independent clinics. Such programs can replace purposely killed animals in anatomy dissection classes and surgery practice. Cadavers and organs can also be specially preserved and perfused with simulated blood and a pulse in order to create a 'live' surgery training experience (Aboud et al, 2004; Optimist, 2007).

Similarly, apprenticeship work with animal patients to teach clinical skills and surgery can and does replace harmful use of animals as the standard approach in many universities (Martinsen and Jukes, 2005). Careful design of field studies can ensure that the animals studied are not disturbed and that there is a beneficial or neutral effect on the animals and the ecosystem (Bekoff, 2005).

Studies within many disciplines show that such approaches are equal or superior to conventional harmful animal use in terms of knowledge and skills

acquisition (Patronek and Rauch, 2007; Balcombe, 2003). However, the impact of the 'hidden curriculum' of practical classes involving animal experiments and the dissection of purposely killed animals must also be addressed when teaching objectives are assessed.

This hidden curriculum teaches the acceptability of harmful and instrumental use of animals and can bring about desensitisation (Capaldo, 2005; Capaldo, 2004; Pedersen, 2002). This can work against the development of the clinical skill of caring – the root of the medical and veterinary medical professions – and can undermine the concept of biology as the study of life. It also devalues the ethical concerns of students and the process of ethical decision-making.

Harmful animal use and its hidden curriculum may also preclude the meeting of teaching objectives that can only be gained through non-animal alternative tools and through animal-based alternative approaches such as ethical field studies and clinical work with animal patients. Such objectives may include a deeper respect for and sensitivity towards animals and ecosystems, a broader awareness of animal behaviour, and the conscious development of care and associated skills.

The implementation of replacement alternatives can remove such a hidden curriculum and allow the gaining of new specific skills and positive attitudes.

### **Conclusion**

It should not be forgotten that Russell and Burch themselves argued that replacement is the primary method for making science humane, with reduction and refinement as secondary measures. Practical experience and studies confirm that full replacement is not only possible but can help meet the higher aim of encouraging humanity in science education (Jukes and Chiuia, 2003; Martinsen and Jukes, 2005). A critical thinking approach to teaching objectives and curricular design that questions conventional harmful animal use (Rasmussen, 2003) can facilitate a curricular transformation that can be achieved rapidly and through replacement alternatives.

It has been argued here that the 1R of replacement, when broadened from its non-animal focus, is sufficient to ensure ethical and effective acquisition of knowledge and skills in life science education and training. These approaches are consistent with best practice and ethical standards, and the roots of the life sciences. They can indeed provide a more comprehensive, effective and fully humane education. Education and training do not depend on harming and killing of animals. If full replacement can be achieved, as argued and demonstrated, then there is also no need for reduction and refinement. Policy and practice should therefore move beyond the 3Rs: education and training is enhanced through 1R, not 3.

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