The need for a philosophical grounding in higher degree science research programmes

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As the learner climbs the ladder of formal education, the role of the teacher transforms from the primary provider of knowledge to that of a mentor. At the university, the learner enters the realm of self-learning, which is synonymous with 'research' in a broad sense. Traditionally, attainment of research capability is measured by the degree of Doctor of Philosophy (Ph D). This measure goes with the assumptions that the person with a Ph D has documented a cognizable and worthwhile doctrine and that the person has contributed to construction of new knowledge. The literature on research theory and practice indicates that any course work on research methods is often either difficult or uninteresting to learners. This may be (i) because the subjects that constitute research methods have not been aligned with the research themes chosen by learners and/or (ii) because the learners have not been appropriately grounded in the philosophical theory that explains the contextual basis for valid research methods. Addressing these gaps, I have argued for the use of the pedagogical tool of 'constructive alignment', integrating philosophical concepts with the themes chosen by the learners for their research activity. I have demonstrated the argued point with the curriculum design of the subject 'Research philosophies and methods', a prerequisite for senior undergraduate learners enrolled in the natural resource management and agribusiness Honours programmes at Charles Sturt University, Orange, Australia.

Keywords: Constructive alignment, coursework prerequisite, curriculum design, research methods, university education.

The need for greater philosophical grounding in Indian higher degree science research programmes

CURRENT Indian formal education – from primary to university – stresses on transfer of information. In spite of having been a land of profound learning steered by original thinking for hundreds of years, post-independence education in India is more often criticized for its emphasis on rote learning[1–3]. Similar to a spacecraft that relies on support only up to the point of firing, learner reliance on teachers is critical only up to the point of firing of learner spirit to seek knowledge. The role of the teacher gradually transforms from the primary provider of information to one of facilitator and mentor as the learner climbs the ladder of formal education. Simultaneously, the learner develops not only knowledge and knowledge-acquisition capability, but also a desire for learning and becomes an autonomous thinker. Especially as the learner moves to university level, the teacher's role is in enabling the learner to know, determine and select the right tools for acquiring knowledge and to build the capability to think. In such a context, the term 'research' is synonymous with 'self-learning' (also referred as 'self-directed' learning[4]), which refers to the independence of the learner in learning and seeking the truth. Whereas levels of seeking the truth vary within specific contexts of investigation and magnitude as determined by the learner, what seldom varies is that every learner using 'self-learning' seeks the truth.

The capability to undertake research and to demonstrate that capability convincingly to peers drives the lives of academics in universities and technical staff in scientific organizations today. Hence higher degree programmes in universities and postgraduate colleges expend large chunks of time and energy in building this capability in learners. Traditionally the society measures this capability by the degree of Doctor of Philosophy (Ph D). At least two assumptions go with the declaration that a person has qualified for a Ph D: (i) that the person so qualified has documented a cognizable and worthwhile doctrine (therefore, the title 'Doctor'), and (ii) that the person has contributed to construction of new knowledge. In principle, a strong level of motivation and commitment is the founda-

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tion for any higher degree programme (HDP; e.g. Ph D) that entails a rigorous level of self-learning through a research activity[5]. In practice, however, a strong level of motivation is also assumed in learners enrolled in HDPs. Coursework prerequisites that deal with the theory on research methods are often considered either difficult or uninteresting by learners in different HDPs[6,7]. This could be the result of two factors: (i) subjects that constitute research methods have not been constructively aligned with the generic research theme chosen by learners; and (ii) learners have not been appropriately grounded in the philosophical theory underpinning the research paradigm of their particular project.

Against such a background, in this article I reiterate the contextual basis of research – drawing from the evolution of efforts of seeking the truth in India and in the West – so that the basis could be meaningfully integrated in the curriculum design of HDPs in India. I also highlight the need for a constructive alignment (CA) of a coursework subject on research methods, with the themes chosen by the learners for their research activity.

Evolution of efforts seeking truth: contexts of ancient Indian and Western worldviews and modern research

Education in ancient India, far less structured and formal than it is today[8], emphasized attaining wisdom through 'thinking', articulated by reasoning. In doing so, ancient Indians sought wisdom through their search for knowledge that enabled them to perceive the truth and by aligning the acquired knowledge constructively with their life experiences. Chronicled information[9] lists six major worldviews (*darsana*) between 500 BCE and 900 CE: the *Samkhya*, *Yoga*, *Vaisesika*, *Nyaya*, *Mimamsa* and *Vedanta*. With the exception of *Yoga* and *Mimamsa*, which essentially deal with spiritual and ritualistic practices, respectively, the other four worldviews bear clear links to modern scientific research. The *Samkhya* worldview (*c.* 500 BCE) recognizes truth within the milieu of two primers: the *purusa* (spirit; the central point of consciousness) and the *prakriti* (substance; the fountainhead of all material existence)[10]. The *Vaisesika* worldview (*c.* 400 BCE) espouses atomism, arguing that all forms of the physical universe are of finite number of atoms[11]. The *Nyaya* worldview (300 BCE–150 CE) champions that truth can be perceived only through sensual perception (e.g. seeing, hearing), thinking and reflection[12]. Intense discussion is currently ongoing in seeing principles of quantum physics in *Vedanta*[13]. Historians of Indian philosophy explain that at different periods of time, one or more of these worldviews merged (e.g. the *Vaisesika–Nyaya* worldview) and because an exploration of such coalescences is not the purpose of this article, the reader is referred to Sharma[14].

In these worldviews, the context for the search of truth exists within well-defined epistemological frameworks. For example, 'analysis' is the underpinning theme of the *Samkhya* worldview[15]; the *Samkhya* epistemology is driven by three stages of derivation of knowledge: (1) via direct sense-based perception (*prayatksa* or *dristam*), (2) via logical inference (*anumāna*) and (3) via verbal testimony (*sabda*). The *Vaisesika* epistemology, which evolved at a later period of time, accepted derivation of knowledge via the direct, sense-based perception and logical inference and rejected verbal testimony. Nonetheless, the *Nyaya* epistemology, which is thematically proximal to the *Vaisesika* worldview, validated logical inference via comparison using metaphors and similes (*upamāna*) and verbal testimony (*sabda*)[16]. Of these, *Nyaya* is driven by reasoning, which enables perception of either a subject or an object, derived through proofs. The *Nyaya* worldview enables inference through proposition, syllogism, exemplification and deduction mediated by cognition, establishment of relationship and meaning making[17]. In fact, *Nyaya* explains that a subject or an object – for a true understanding – can be re-examined after it has been validated through other sources of knowledge (*anviksa*)[18].

Similar investigations of truth have occurred elsewhere as well and the contributions of the Greek trio (Socrates, Plato and Aristotle; 500–400 BCE) cannot be overlooked[19,20]. Plato, in his *Republic*, refers to education as illumination – a process similar to the gradual adjustment of a blindfolded human eye when exposed to pure, dazzling, brilliant light. The imagery is similar in the ancient Indian context[21].

The contemporary definition of science is that it is a system of ideas, a body of statements on the material universe; only logical consistency, and especially evidence, serves as a check to assess the accuracy of ideas about the world around[22]. In short, contemporary understanding of science and scientific practice emphasizes reasoning and rational evidence as key characteristics of science, in addition to the important roles played by objectivity and parsimony.

Modern scientific research builds on empiricism as laid out by Francis Bacon (1561–1626 CE), who emphasized avoidance of preconceived notions and prejudices in seeking the truth. To René Descartes (1596–1650 CE), a radical revisionist, understanding truth began on the premise of doubting (i.e. questioning of validity), although Descartes subscribed to innate ideas, i.e. intuition – knowing things without having to rely on sense-based perception. More definite contexts came from further establishment of empiricism driven by experience; that realization of truth and acquiring of knowledge can be derived from the iteration of the processes, viz. sensory input, emotional response and self-generated thought[23].

Whereas the frameworks for search of truth via knowledge occurred in India and Greece between 500 BCE and 900 CE[24], the frameworks for definitive methodologies

emerged in Europe in the XVIII–XIX centuries. Churchman[25] has proposed a 'systems' model depicting the philosophy of methods (= methodologies) and use of right research design by proposing 'inquiring systems', to achieve learning with greater clarity. Churchman's systems are constructed on the thoughts of Gottfried Leibniz (1646–1716 CE), John Locke (1632–1704 CE), Immanuel Kant (1724–1804 CE), George Hegel (1770–1831 CE), and his own, plus that of his mentor, Edgar Singer (modelled as the Singer–Churchman inquiring system). The Churchman commentary[25] arguing on the criticality of systems design has unequivocally established that procedures and protocols employed in scientific research are of vital practical importance, as much as the vertebral column is for the perpendicularity of *Homo sapiens*.

Constructive alignment, a useful framework in the design of HDP curricula

The theory of CA emphasizes that learners should be empowered in a manner that they can construct meanings from what they do to achieve learning, whereas the teachers should be able to align the activities intended for learning with the outcomes expected at the conclusion of learning[26]. The premise of CA is that the curriculum should be so designed that the learning activities and assessment tasks remain positively aligned with the intended learning outcomes, establishing contiguity and consistency. To what extent could CA be integrated in the curriculum of HDPs, so that the capability to think can be enabled in learners? To answer this question, I provide here the subject 'Research philosophies and methods', which I have been teaching and coordinating in Charles Sturt University–Orange campus (CSU–O), since 1999, as an example.

Constructive alignment of 'research philosophies and methods' in CSU Honours programme in Orange

'Research philosophies and methods' (AGR 420, 12 credit points weightage) is a coursework prerequisite for students pursuing their research-based undergraduate Honours degree programme in natural resource management and agricultural business management. It is a one-semester long coursework subject taught to learners commencing Honours study, which is a pre-requisite for the major 'thesis' subject 'Research dissertation' (AGR 580, 48 credit points weightage). To pass the Honours with a third class, a 60% score ('Research philosophies and methods' – 25% + 'Research dissertation' – 75%) is necessary. Whereas 'Research dissertation' refers to completing a 20,000-word long dissertation based on an original research investigation, 'Research philosophies and methods' captures the context and a majority of themes outlined in the preceding sections of this article.

'Research philosophies and methods' aims to provide learners with a sound understanding of the major philosophies and theoretical movements that have directed global thinking so far and that continue to influence the development of knowledge and methods, and the tools and techniques each of these methods employs. It also aims at enabling the learner to determine the precise theoretical context and the most appropriate method(s) for use in their specific research context (viz. 'Research dissertation'). The core learning material in 'Research philosophies and methods' is presented to learners in two modules: (1) 'Research philosophies' and (2) 'Research methods'.

Learning objectives of module 1 have been designed in a manner such that at the conclusion of learning of this module, the learner would be able to analyse and discuss: (i) the historical contexts and principles of major movements in the Western philosophy, (ii) the implications of these movements in the understanding of the truth (as outlined in the Western philosophy), (iii) the major philosophical bases to the process of inquiry that have emerged from Western thinking, (iv) the defining characteristics of those major philosophical bases to inquiry, (v) the implications of those bases for the manner in which modern research is conducted and (vi) the characteristic values of knowledge and skills that have evolved as a result of research.

Learning objectives of module 2 have been developed in a manner such that at the conclusion of learning of this module, the learner would be able to analyse and discuss: (i) the major methods available to researchers investigating agricultural business and/or natural resource management, (ii) the criteria that need to be selected from amongst the available methods when proposing a new research project and (iii) the planning and implementation of a research project and time management. The learner would also be able to defend his/her research proposal employing synthetic and logical arguments, and communicate his/her findings to an academic and/or industry audience and to the wider community using a formal language, appropriate to the intended audience.

Assessment tasks include presentation of two written assignments (following formal and professional etiquette). The assignments are assessed on the criterion whether they achieve one or more of the following levels: pre-structural, unistructural, multistructural, relational, and extended abstract, following Biggs[27]. Assignments that convincingly demonstrate the learner's ability to function at either relational or extended abstract levels are those that demonstrate a wide appreciation of the understood concepts by embedding them meaningfully in the research theme chosen by the learner (vide the second subject requirement, 'Research dissertation') and by comparing and contrasting other related data and contexts. Through these assignments, the learner has to demonstrate a clear understanding of either inductive or deductive reasoning (or both) – in an appropriate manner – after resolution of in-

consistencies and by drawing on appropriate analogies supported by relevant empirical data and making considered inferences and meaningful conclusions. Most critically, the extended abstract context relies on the manner in which the learner builds convincing links between the philosophical and methodological theories, and also the actual research topic he/she had chosen for detailed investigation under the subject 'Research dissertation'.

Conclusion

I have argued for a contextual basis for academic research training both in terms of seeking the truth and in terms of the philosophical underpinnings of methods (= methodologies), so that my effort could be meaningfully articulated in the curriculum design of HDPs in India. I have referred – briefly and discreetly – to the evolution of the rich tapestry of ancient Indian wisdom and have touched on the key elements that display features that link with modern science research. Even 2000 years ago, India pioneered in providing leadership in rational and relational thinking and in articulating those thoughts logically and on strongly founded reason. In the latter part of this article, I have provided an example of curriculum design using 'Research philosophies and methods' (Honours programme, CSU–O) to demonstrate how constructive alignment could be easily established in integrating philosophical underpinnings in a research-based HDP in science. My interest in writing this article is to point to what appears lacking, so that a conscious and designed effort could be made in capturing our rich heritage and recreating a self-learning mechanism, to enable active and dynamic thinking in learners in the future Indian higher degree research programmes in science, including medicine, engineering and management. I offer these suggestions from the vantage point of having been active in research and education in India from 1971 to the mid-1996 and in Australia from the late 1996 to date.

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