The legacy of John Dewey: His contribution to cyclical and iterative processes and its potential for addressing contemporary problems

Based on an AARE Online conference presentation celebrating the work of John Dewey in February 2022

Dr James Harrison and Dr Henk Roodt
College of work based learning Otago Polytechnic New Zealand

February 2022

Abstract

John Dewey is hailed as the father of experiential learning and yet it was his recognition of a long tradition of knowing how, when he challenged the new educational paradigm of theory preceding practice. Instead of just arguing for practice led education, he analysed its components and identified a cyclical process, where understanding from observation, analysis, synthesis and then trialling demonstrated how practice delivered theory. It is the cyclical process which underpins many processes of learning, problem solving and action-based research that remains prevalent today. In his recent PHD studies, Harrison (2021) identified that a cyclical framework of developmental practice and its iteration continued to underpin most vocational and professional practice and its ongoing stability. Engineers solve engineering problems, doctors medical problems, electricians electrical problems, and hairdressers hairdressing problems. However, due to human impact on the natural environment and resource needs, the nature and frequency of wicked problems are multiplying exponentially and people are finding that a single discipline solution is becoming increasingly difficult. The purpose of this paper is to acknowledge the cyclical and iterative nature of problem solving synthesised by Dewey but to explore how this may be evolved still further using transdisciplinary practice explained by work from Roodt and several collaborators (Roodt & Koen 2014), (Roodt 2015), (Roodt & Dempers 2020) and (Van Zyl & Roodt 2020)

The heritage of John Dewey

John Dewey (1859-1952) was a tour de force in several fields and disciplines in the first half of the 20th century, producing important contributions in modern psychology, education of the whole person and a founder of pragmatic research. All these diverse activities and outcomes bear strong witness to our work today in which we see the need for all professional practice to become more multi-faceted and transdisciplinary to address the number of wicked problems our modern society is facing. Moreover, it is the simplicity and commonality of what he was doing then that resonates strongly with the work we are describing in this paper, where many processes are common and stable to a diverse range of problems that at first sight appear to need different treatment.

Dewey considered that it was important not only for young people to be educated about the what of the world but the why and to be able to develop the necessary processes that would enable them to find meaningful results from inductive and deductive reasoning. This forms the basis of his book "How we think" (1906) in which he articulated a reflective process of examining real world puzzles. This included noticing that something was different than before, analysing what the difference was and what could be done about it, and then trying out some changes practically to resolve or acknowledge a development in a previous understanding. This meant that young people were not only prepared for the familiar, but also for the changes they would meet during their lives.

Later in 1936 Dewey published a further book “Experience and Education” to criticise the preponderance of schools delivering expert theory to students without grounding it in experience and practice students could relate to. He argued that a philosophy of experience needed to be developed before a philosophy of education as the latter was required to enable the former. Activity leads to experience, and this enables an expansion of worthwhile practice. Such interaction provides motivation to students in the sense that their natural curiosity is closely related to scientific experimentation and such freedom can be guided over time towards maturity and self-control and inbuilt comprehension of cause-and-effect scenarios.

It is the implicit comprehension of cyclical and iterative process that Dewey identified here that provided such significance to Harrison’s (2021) PhD findings

The PhD findings of James Harrison

Harrison’s (2021) PhD study set out to identify the processes by which a group of experienced professionals were developing their practice with little post-graduate education or training.

Initially, it was assumed that this involved conventional forms of experiential learning but findings from a series of detailed interviews with several individuals indicated a more extensive answer. That is learning and development was primarily arising from ongoing practice, which was largely unconscious to them, but which resulted in more complex practice through time. That is learning and development was a result rather than a cause of their growth.

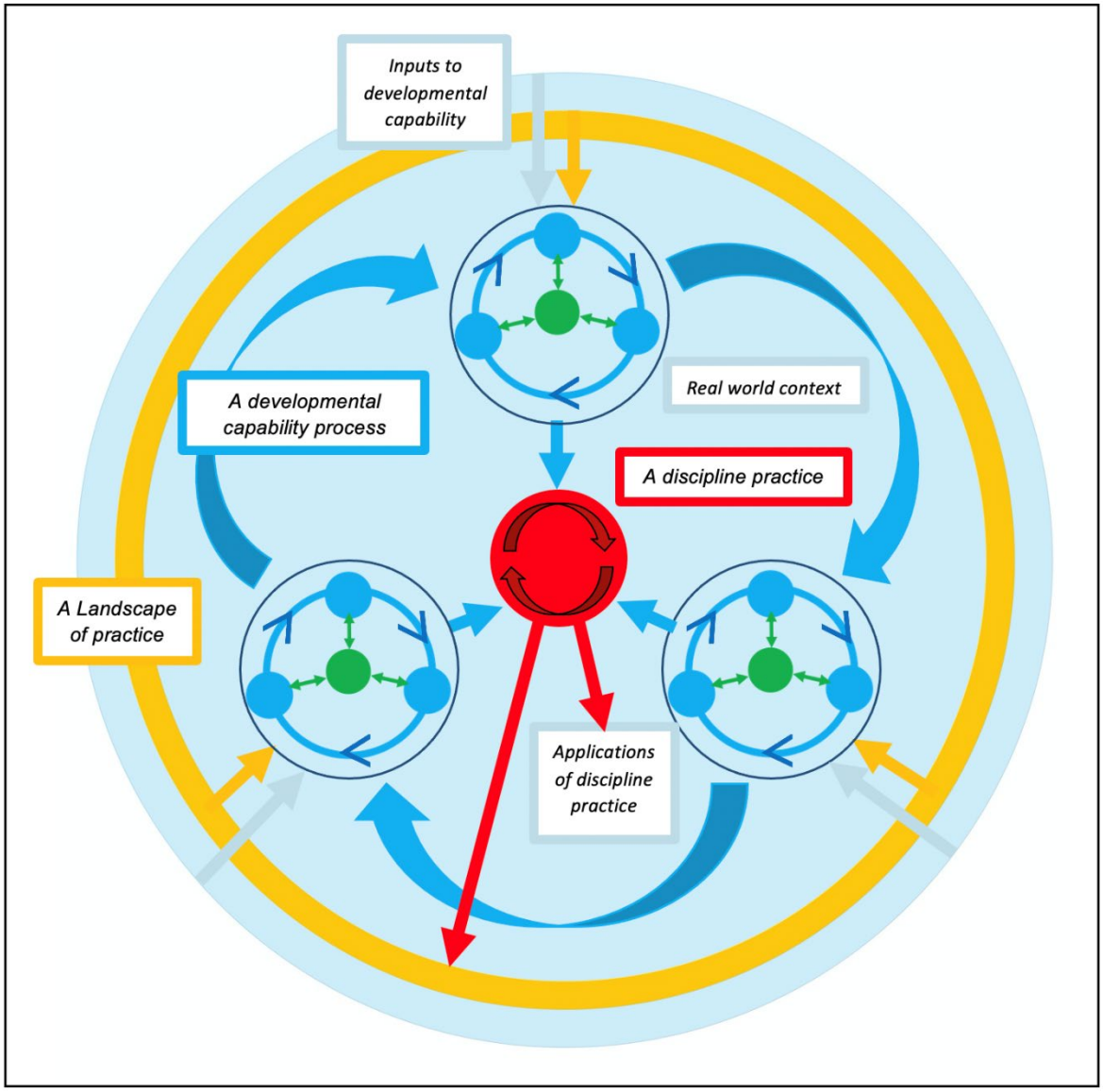
This led to the conclusion that there were cyclical processes of practice that were involved. Closer examination revealed that the main candidates were problem solving variants including pragmatic research and project work. Earlier work by the author had identified that the main processes or functions of professional groups were largely stable though time and it was then further realised that the functions the professions represented were contextual forms of problem solving.

The framework of developmental practice for vocational and professional roles was derived from two dimensions of a generic problem-solving process:

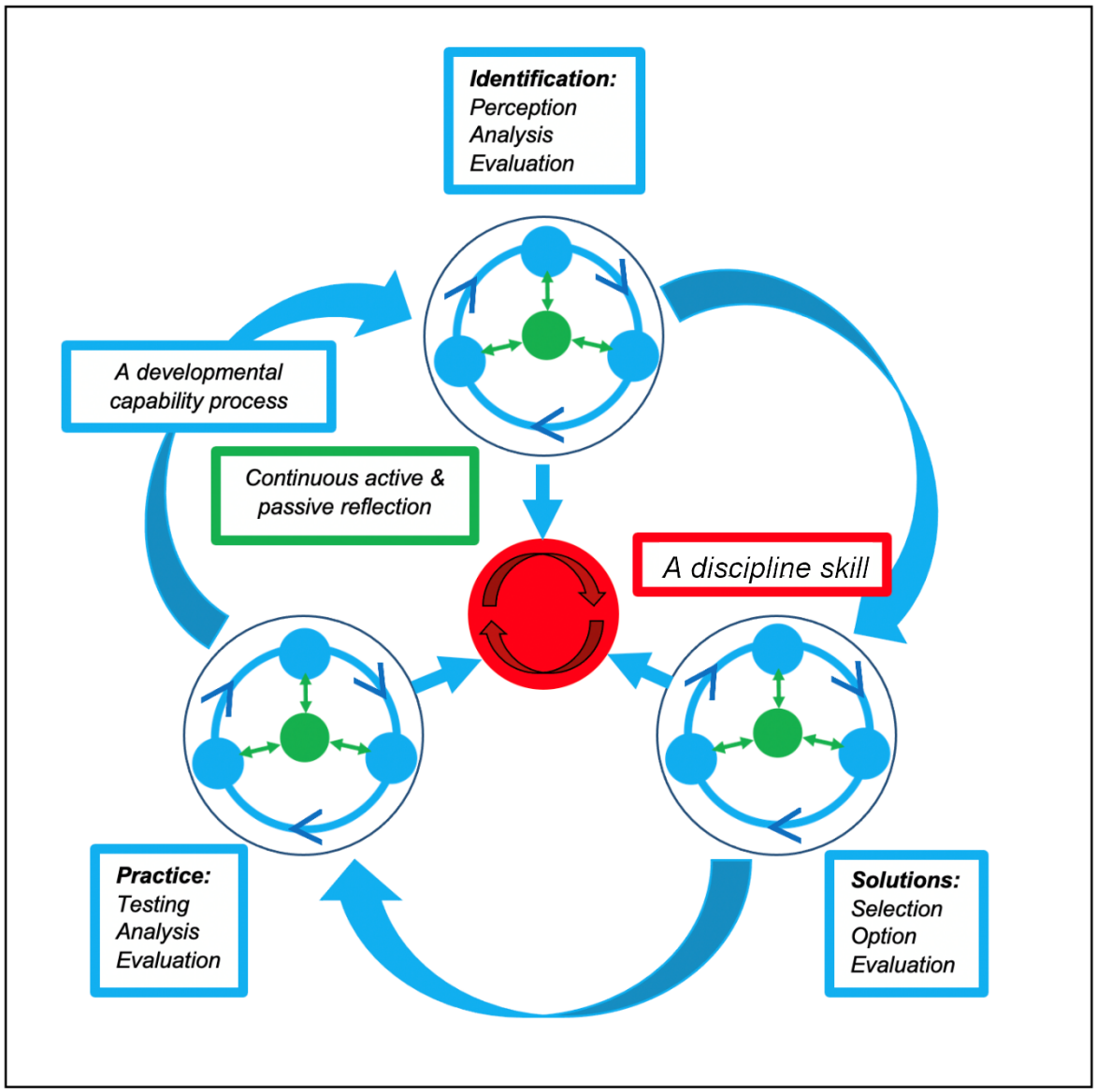
- The first dimension is associated with the concept of capability expressed by Stephenson and Yorke (1998) as the ability to extend existing practice into more complex or unknown areas by using a developmental process cycle
- The second dimension is associated directly with solving a problem in the vocational or professional discipline an individual is involved with. This is based on the existing practice (Knowledge and skills) an individual is familiar with

In practice, both dimensions are being addressed simultaneously.

This framework is shown below for an individual operating in a social and general environment context.



Framework of Developmental Practice for vocational roles in context ©James Harrison 2020



Individual components of Development Framework of Practice ©James Harrison 2020

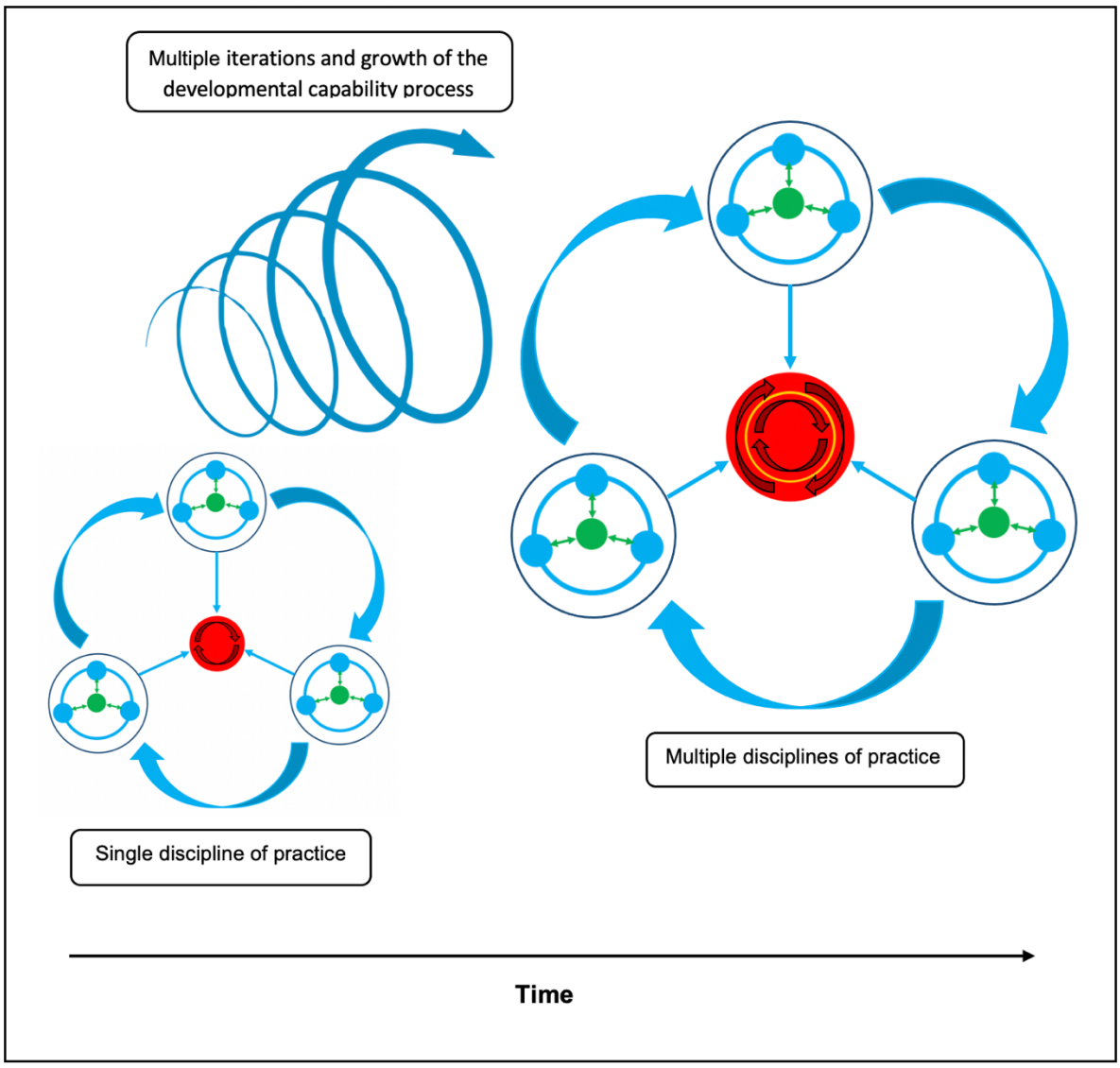
In this diagram a problem is perceived and analysed in the first sub-cycle of the developmental capability cycle. Reflection is used at every stage of the sub-cycle to check and enhance the comprehension and findings emerging. The importance of the cycle is that it is capable of repeat iteration until a satisfactory result is achieved. At every stage information can be sought and consultation of others can happen to improve the quality of the process and results arising. Progression to the next sub cycle is made when an individual considers the result is an optimum one.

Each sub-cycle involves a continual process of both active and passive reflection. Active reflection is convergent in that it is consciously looking at the most significant results from each stage of the process and their coherence with the overall purpose of the problem and its solution; whereas passive reflection is divergent in that it is seeking linkages from aha moments that may bear no logical relationship to the matter but still have relevance.

The second sub-cycle then examines the relevant solutions, and which might be applied.

The final sub-cycle trials a solution in practice to see whether the problem is resolved or needs further work. Note that the problem relates to a specific area of skill or practice, but the results improve both general capability as well as breadth and depth of practice.

Again the significance of the whole cycle is the awareness of progress made through the cycle and whether further iterations of the complete cycle are needed to further refine the results needed. The automatic comparison between the initiation of any cycle and the outcome at the end provides a big picture sense of development and learning achieved.



Growth of Framework of Developmental Practice through time © James Harrison 2020

This diagram illustrates how an individual develops both their specific practice skill or competence as well as their generic developmental capability through time. The important result here is that the same process is being developed and built through different problems, work and careers.

Whilst the overall process is generically common for different individuals, the detailed techniques, knowledge, and skills are entirely unique. This naturally leads onto the concept of transdisciplinarity that is acquired through this development process.

The place of transdisciplinarity in contemporary research and problem solving

Transdisciplinarity can be approached as an axiomatic philosophical world view (Nicolescu, 2010) and as a methodology (Van Breda & Swilling, 2019). According to Julie Thompson Klein (2004) transdisciplinarity is a scientific and cultural approach that facilitates dialogue between specialists that recognise the complexity of the world in a way that contextualises ways of knowing. It is also pointed out that the societal problems are increasingly 'wicked' (Rittel & Webber, 1973) and not situated in single disciplines or sectors. For example, the environmental disaster of resource plundering includes aspects of national legal enforcement frameworks, social dynamics and poverty, international crime, and ecosystem science (Koen, Roodt, et al., 2017). Transdisciplinary research focuses on addressing societal issues by considering different ways of knowing without disciplinary preconception and is holistic and integrative (Van Zyl & Roodt, 2020), including society in the practical search for resolution and change (Hirsch Hadorn et al., 2008). While inclusive practice is important, there is an awareness of the danger of transferring risk onto society while attempting to link human agency to complex system change (Van Breda & Swilling, 2019). Finally, there is the ethical imperative of provisionality and considering unintended consequences with emerging patterns resulting from our interventions (Woermann & Cilliers, 2012).

In a nutshell, transdisciplinarity requires reflective and reflexive practice (Hirsch Hadorn et al., 2008). The aim is development of "descriptive, normative and practice-oriented knowledge in order to help solve, mitigate or prevent life-world problems" (Pohl & Hadorn, 2008, p. 111).

In this paper we focus on experiential learning, problem-solving, and knowledge generation and the cyclical nature of the process. The beautiful link between the insights of Dewey and transdisciplinarity is captured when Dewey (2005, p. 21) proclaims:

"I believe finally, that education must be conceived as a continuing reconstruction of experience"

and when Edgar Moring (2008, p. 50) states:

"*But in recursive logic, we know very well that what we acquire in terms of knowledge about the parts feeds back on the whole. What we learn about the emerging properties of the whole, a whole that cannot exist without organization, feeds back on the parts. So we can enrich knowledge of the parts through knowledge of the whole and knowledge of the whole through knowledge of the parts".*

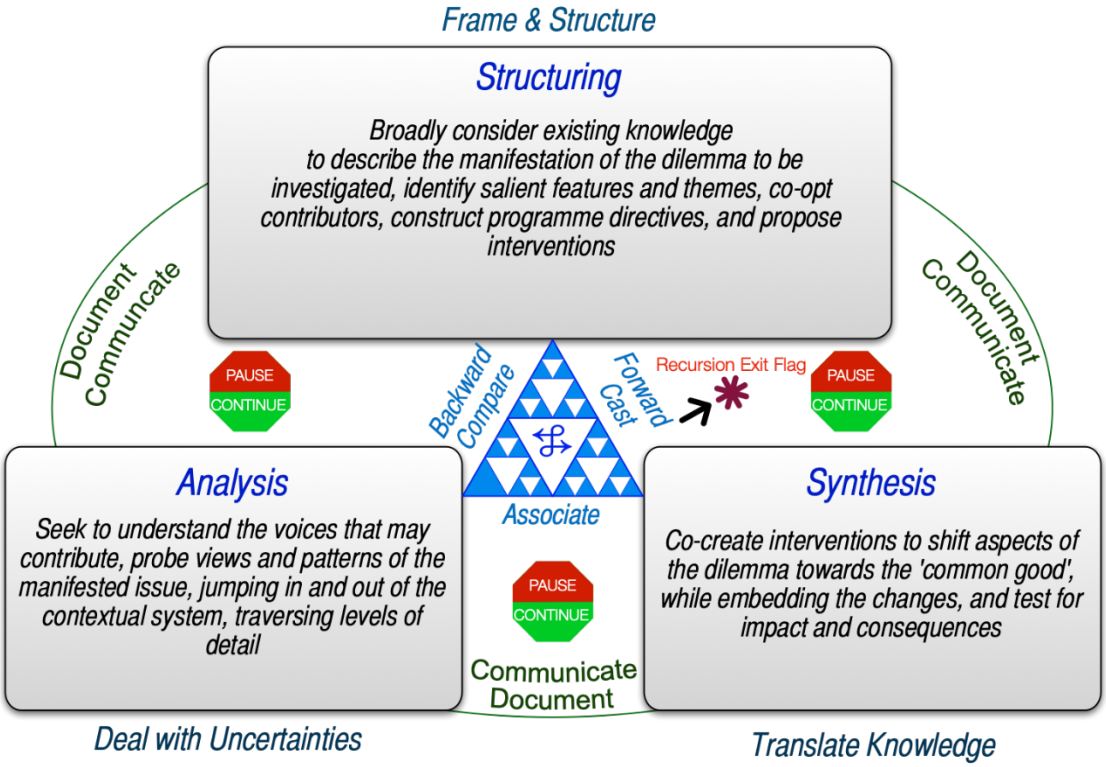
The reflexive and recursive nature of transdisciplinary problem-directed, society-based practical research is the basis of work-based studies. Not all studies need to embrace societal dynamics and complexity, but where it does, we believe that we must go beyond individual knowledge and experience in the classic disciplines and gather the insights from the broader human knowledge base of lived experience too. Transdisciplinarity equally asks that we draw on the current disciplinary knowledge, making sure that we use all the wisdom available to us.

The Transdisciplinary Practice – Action Framework shown below highlights the iterative and cyclical process. What is important here is that we stick to Morin's concept of emergence on all fronts of conceptual structuring, analytical effort and synthesized insight as we work on the dilemma of interest. The process requires the flexibility of moving around the processes as needed and the rigour of documentation (via artefacts that best suit the context of the work). The recursive process relies on backward comparison with prior understanding, reconstruction of meaning and association with other lived experiences. Forward casting considers consequences and possible emergent patterns. The structuring of the problem space is ongoing, while simultaneously analyzing and synthesizing new insight.

What brings such an evolutionary process to a close? An agreed exit flag consisting of resource limits, agreed resolution, or even 'giving up' after the issue had been shifted and documented and the 'research team' disband by necessity, may act as valid exit points. Clearly transdisciplinary research is fraught with uncertainty and risks and like life itself, there are no guarantees, except that all team members will gain experience and wider knowledge through actions and reflection.

An example of such a project is the investigation into rhino poaching in Africa reported on by Koen et al. (2017). Although the initial study was focused on finding ways to protect the rhinos using a better understanding of their patterns of grazing and traversing a reserve and how poachers operate, it soon became clear that the team had to be expanded. It initially included park rangers and some law enforcement, but soon the military became involved (the rhinos are situated in a cross-border park), social scientists came on board to understand the poverty and crime relationship in communities around the park, and where the modelling team was initially focused on the rhinos, the study became more focused on the human condition threatening the rhino population. The study eventually split into several sub-studies and the work is ongoing, despite some of the original teams not being involved anymore. Learning impacted a range of disciplines and research instruments (de Waal et al., 2016; Koen, de Villiers, et al., 2017; Koen, Roodt, et al., 2017)

Transdisciplinary Practice – Action Framework (adapted from Hirsch Hadorn et al. (2008))



Conclusions

Both authors have found that by sharing and comparing these two frameworks that they offer potential of a mutually beneficial larger framework than either suggests. Firstly, that Harrison's framework was largely developed to support individual development. within a social community of practice of the kind described by Lave and Wenger (1992). It is showing how individual capability and competence can support community development. Where Roodt's framework was developed by harnessing the transdisciplinarity of new groups of diverse individuals to bring a necessary wider and

deeper approach to solving the increasing dilemma of contemporary wicked problems and in so doing an individual becomes more aware of the value of transdisciplinary in their own practice.

Having said that, there is much in common between them.

Firstly it is self-evident that it is important for individuals to increasingly have a transdisciplinary approach themselves to support their ability to solve more complex problems. And that due to individual experience in life people are automatically bringing variation to their practice which provides agency in developing an individual discipline more rapidly.

Secondly, it is that social communities of practice are better able to solve wicked problems when there is conscious comprehension for the need of transdisciplinarity to evolve though problem solving, research, and resultant learning.

Thirdly both processes show that that repetition and iteration leads to progressive development not simply in one discipline or problem but in many. This enables individuals to become more agile at taking up a variety of disciplines in a lifetime of careers

Finally, better recognition of personal development and practice processes enables both to be undertaken simultaneously and that theory and practice are required together for optimum progress.

The important linkage of our work to the legacy of John Dewey is that despite the passage of time, re-visiting his works continue to provide refined interpretations of his transdisciplinary thinking and pragmatic practice.

In our practice of postgraduate mentor-facilitation we have discovered that being cognisant of these two frameworks and by carefully weaving them into each session, we can contribute to critical thinking and reflective consideration in the way our learners see and make sense of their practice. The process is reciprocal and as we journey together with the learners and their work-based learning, we continue to reconstruct our experiences and broaden our ability to address the issues of the day.

Our collaborative work in this area is ongoing. Harrison plans to focus on investigating links between his developmental framework of practice and Māori and Pasifika concepts of learning and development.

For his part Roodt plans to consider how the congruence of these two frameworks may be used towards developing and enhancing learner agency and the ability to consider practical consequences of accepting and practising the different values underpinning transdisciplinarity.

References

de Waal, A., Koen, H., de Villiers, P., Roodt, H., Moorosi, N., & Pavlin, G. (2016). Construction and evaluation of Bayesian networks with expert-defined latent variables. *2016 19th International Conference on Information Fusion (FUSION)*, 774–781.

Dewey, J. (1906) *How we think*

Dewey, J. (1936) *Experience and Education*

Dewey, J. (2005). My Pedagogic Creed. In D. J. Flinders & S. J. Thornton (Eds.), *The curriculum studies reader* (2nd ed.). Taylor & Francis e-Library.

Harrison, J. (2021) *A developmental framework of practice for vocational and professional roles.* Retrieved from https://vuir.vu.edu.au/42717/

Hirsch Hadorn, G., Hoffmann-Riem, H., Biber-Klemm, S., Grossenbacher-Mansuy, W., Joye, D., Pohl, C., Wiesmann, U., & Zemp, E. (Eds.). (2008). *Handbook of Transdisciplinary Research*. Springer.

Koen, H., de Villiers, J. P., Roodt, H., & de Waal, A. (2017). An expert-driven causal model of the rhino poaching problem. *Ecological Modelling*, *347*, 29–39. https://doi.org/10.1016/j.ecolmodel.2016.12.007

Koen, H., Roodt, H., & de Villiers, J. P. (2017). System-level causal modelling of widescale resource plundering: Acting on the rhino poaching catastrophe. *Futures*, *93*, 102–114. https://doi.org/10.1016/j.futures.2017.05.006

Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

Morin, E. (2008). *On complexity*. Hampton Press (NJ).

Nicolescu, B. (2010). Methodology of Transdisciplinarity–Levels of Reality, Logic of the Included Middle and Complexity. *Transdisciplinary Journal of Engineering & Science*, *1*. https://doi.org/10.22545/2010/0009

Pohl, C., & Hadorn, G. H. (2008). Methodological challenges of transdisciplinary research. *Natures Sciences Sociétés*, *16*(2), 111–121.

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*(2), 155–169.

Roodt, H., & Koen, H. (2014) Engineering design of an environmental management system: A transdisciplinary response to the rhino poaching problem. In *INCOSE International Symposium* (Vol. 24, No. s1, pp. 346-359).

Roodt, H. (2015) The recursively generative nature of complex agri-eco-socio-technical systems: a transdisciplinary approach to developing a low carbon footprint farming system. In *2015 Annual IEEE Systems Conference (SysCon) Proceedings*, 2015, pp. 521-526, doi: 10.1109/SYSCON.2015.7116804.

Roodt, J. H., & Dempers, C. (2020) Addressing Challenges of the Circular Economy using Model-Based Co-Creation and Systems Design. In *INCOSE International symposium* (Vol. 30, No. 1, pp. 94-108).

Stephenson and Yorke (1998) *Capability and quality in higher education*. Kogan Page.

Thompson Klein, J. (2004). Prospects for transdisciplinarity. *Futures*, *36*(4), 515–526. https://doi.org/10.1016/j.futures.2003.10.007

Van Breda, J., & Swilling, M. (2019). The guiding logics and principles for designing emergent transdisciplinary research processes: Learning experiences and reflections from a transdisciplinary urban case study in Enkanini informal settlement, South Africa. *Sustainability Science*, *14*(3), 823–841.

Van Zyl, H., & Roodt, J. H. (2020). A Transdisciplinary Design and Implementation of Sustainable Agricultural Principles in the Waikato Region of New Zealand. *INCOSE International Symposium*, *30*(1), 637–650.

Woermann, M., & Cilliers, P. (2012). The ethics of complexity and the complexity of ethics. *South African Journal of Philosophy*, *31*(2), 447–463.