

# MĀTAURANGA MĀORI AND THE DATA–INFORMATION– KNOWLEDGE–WISDOM HIERARCHY

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## A conversation on interfacing knowledge systems

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### Abstract

This paper explores the interface between mātauranga Māori (Māori knowledge) and a model used to describe knowledge systems known as the Data-Information-Knowledge-Wisdom (DIKW) hierarchy. By considering how DIKW describes a non-Western knowledge system, we reveal ways that the DIKW pyramid concept may be expanded. We first explore the practices that mātauranga Māori draws upon to establish relationships between data, information and knowledge, considering particularly how the concept of whakapapa interfaces with the DIKW pyramid model. Using the theory-ladenness of observation concept, we recast the DIKW pyramid as a prism, or an observational lens with unique refractive properties that depend on the worldview and lead to different ways of seeing. We finally consider how the DIKW pyramid (or prism) can be reoriented to describe the knowledge-information-data exchange that occurs in the oral transmission of mātauranga Māori. Through this conversation, we demonstrate that this area of knowledge can be shaped by mātauranga Māori, but that mātauranga Māori ultimately transcends any descriptive work that the DIKW pyramid can do upon it.

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## Keywords

mātauranga, DIKW pyramid, science, indigenous knowledge, interface

### Introduction

The socio-cultural reach of scientific endeavours has given rise to a complex set of situations and milieu that require problem-solving across knowledge systems. In Aotearoa New Zealand, these operations mostly take place at the so-called interface between mātauranga Māori and “Western” science, generating philosophical and epistemological debate, research activity and government support for generating potentially new insights from two ways of seeing. A common goal or shared problem usually drives such collaborations, but in practice it takes a negotiated space (Hudson, Roberts, Smith, Hemi, & Tiakiwai, 2010) for people with different worldviews to work together for equitable outcomes. Genuinely equitable partnerships are rare, however, with “consultation” characterising the largely instrumentalist approach of scientists, who incorporate mātauranga Māori into science by treating it as evidence, or data, to be used in constructing solutions to natural problems. Although Māori may also be interested in science for instrumental reasons, because that is what natural sciences appear to offer, this approach tends to set practitioners of mātauranga Māori on the back foot. A growing number of iwi collaborate with scientists on conservation, resource management and energy projects, which increases the need for discussion on the philosophical worldviews underpinning these interactions.

Much has been written about the differences and similarities between Western science and indigenous knowledge (IK), with common ground ideas (Barnhardt & Kawagley, 2005; Roberts, 1996; Stewart, 2007), convergence models (Barnhardt, 2007; Mercier et al., 2008) and cultural interface approaches (Durie, 2005; Mercier, 2007; Nakata, 2007) making entry

points into the discussion. However, these are ultimately limited because mātauranga encompasses a whole Māori philosophy, where science (typically taken to mean natural and physical sciences) has a narrower, disciplinary scope within a broader “Western” philosophy. Clark goes so far as to label mātauranga Māori and Western philosophy as “competing epistemic positions” and “different in some fundamental way and therefore not comparable” (see Clark, 2006, p. 178). However, that approach misses the collaborative potential that has been realised in a multitude of projects involving indigenous people. Discussions at the interface have thus far tended to be heavily generalised, with the debates falling into the polarities that Clark warns of (such as science = reductionist, and mātauranga = holistic). Instead, our discussion focuses on a specific model in Western philosophy, asking how it interfaces with comparable concepts in mātauranga Māori, and what differences, or system limitations, does the comparison expose? What work can be done to reinterpret, reshape and expand a Western model, based on understanding from another perspective?

We chose to focus this exercise on Ackoff’s Data-Information-Knowledge-Wisdom (DIKW) pyramid, as it has application in many areas of Western philosophy and it can arguably describe mātauranga Māori (see the next section). Most importantly, DIKW enables a discussion of *knowledge-producing* practices, rather than “science”, which enables us to disentangle somewhat from a position of cultural relativism that dogs the debates about “Māori science” (see Stewart, 2007). Finally, DIKW serves as a relatively accessible model for students, leading to exercises for teaching and thinking about the interface. Here we present ideas from student authors with different

cultural backgrounds, modelling the quality of insights drawn from students in a creative, challenging and enabling teaching environment.

This paper, thus, does some key things. It explores a possible conversation between mātauranga Māori and science on a specific model (the DIKW pyramid). It contrasts the ways of seeing that come from different perspectives. Most significantly, it asks how the Western DIKW knowledge model can be adapted, with mātauranga Māori as the benchmark. It thus models an interface discussion that puts mātauranga Māori in the driver's seat.

### The DIKW pyramid

The DIKW pyramid is a knowledge systems model often attributed to R. L. Ackoff (1989), which claims to be applicable to many systems of understanding. While the model originates from and has direct relevance to information systems and knowledge management (Cram, 2002) it has also been applied in and adapted for other disciplines such as business (Faucher, Everett, & Lawson, 2008), engineering (Brodie & Brodie, 2009) and computer science (Awad & Ghaziri, 2004). Here we explore its potential relationship with mātauranga Māori.



**FIGURE 1** The Data-Information-Knowledge-Wisdom (DIKW) pyramid for knowledge systems has been attributed to Ackoff (1989).

The DIKW pyramid is a hierarchy of comprehension with each layer building upon the one below it, as shown in Figure 1. The pyramid base consists of data, which has no significance beyond its own existence—the Roman letters printed on this page can be considered data. Systematisation of pieces of data according to identified relationships (such as the organisation of letters on this page into English words, and words into English sentences) gives data form and structure, which leads to information. As organised data, information generally lacks application—a word, or even a sentence, on its own conveys little. Knowledge emerges when information bodies are organised and connected (for example, sentences in a paragraph) in order to convey a message, or a fact. Wisdom draws upon different knowledges and experiences for its construction. Wisdom may also give insight into questions that do not have a fully attainable answer (Bellinger, Castro, & Mills, 2004).

The Oxford English dictionary defines science as “concerned either with a connected body of demonstrated truths or with observed facts systematically classified ... which includes trustworthy methods for the discovery of new truth within its own domain” (“Science”, 2002, 4a). We use “science” here to denote the processes that draw relationships within and across “facts” or “demonstrated truths”. These loosely correspond to the levels of the DIKW hierarchy: data (facts) produce information if organised in a certain way, systematised information (demonstrated truths) begets knowledge. “Science” thus organises known and verified data and information to productively generate new information and knowledge. Western science includes a range of knowledge generation and verification techniques (see, for example, Chalmers, 1999), but other disciplines, and other knowledge systems, may build different kinds of relationships, and may have different understandings for what constitutes “data” and “information”.

As an example, Polynesian navigators

observed certain birds—sooty shearwaters and godwits—arriving from certain directions at certain times of the year—*data*. Patterns and correlations in the data collected at different islands enabled them to map local migratory routes—*information*. From this they produced the hypothesis (Walker, 1994)—or *knowledge*—of land to the southwest. The understanding that generated this knowledge was eventually tested and proven, when Polynesians sailed out and discovered that land—Aotearoa. Here we take this “science” to be the understanding that generates connections between data, information and knowledge.

There are limitations to the DIKW model. One of its severest critics is Martin Frické (2009), who identifies operationalism and inductivism as philosophical backdrops to the hierarchy, both of which have lost some credibility in the philosophy of science. Operationalism states that “we do not know the meaning of a concept unless we have a method of measurement for it” (Chang, 2009). This is certainly in conflict with elements of mātauranga Māori, such as Pū and Kē, which we discuss in light of reshaping the DIKW pyramid to address this limitation.

Frické also challenges DIKW’s linearity. He sees knowledge production as circular in nature, iteratively producing insight and meaning through recourse to data, information and knowledge all at once. The bottom-up structure suggested by the pyramid shape implies that random data is collected without recognising the reason or knowledge-based impetus for doing so. It represents researchers as data or information gatherers, and this accumulated data has no purpose until enough has been amassed so that it can be transformed into knowledge. Later, we suggest an alternative way to view DIKW on the basis of this criticism. Furthermore, Frické sees wisdom as an artificial holder of the apex position, because there is no appropriate or equivalent explanation of how knowledge is transformed into wisdom.

Wisdom is thus the rarely discussed pinnacle of the DIKW pyramid (Rowley, 2007), but it

bears examination here because of the wisdom implicit in mātauranga Māori. For instance, if asked the question “Where did karaka (*Corynocarpus laevigatus*) originate from?”, a botanist may answer “Karaka descend from plants that once grew on Gondwanaland.” A tohunga might answer “Karaka are the children of Tāne and Rura” (Tawhao Tioke, cited in Waka Huia, 1993). The botanist’s answer will arrive from a piecing together of data, information and knowledge from a paradigm influenced by evolutionary biology. By contrast, the tohunga’s answer derives from data, information and knowledge organisation practices from mātauranga Māori. They may agree that karaka berries are a certain shape and colour (data) in relation to other trees. They may also agree that *karaka* and *tawa* (*Beilschmiedia tawa*) are related (information), although the botanist’s taxonomy will place them further apart than Tioke’s whakapapa, and they will be using different language to describe the relationship. Their analyses would continue to diverge from there. In the DIKW schema, both answers are equally valid wisdoms produced through the connections drawn between distinct D-I-K paradigms. But the tohunga’s wisdom is irreconcilable with the botanist’s, and possibly vice versa. “Where did karaka come from?” is a question not answerable through the collection of empirical data, because it occurred in a past inaccessible by direct measurement. This allows different wisdoms and understandings to emerge from different DIKW paradigms, with connective practices that enable new knowledge and understanding to be produced from similar data. Some cultures may have comparable individual connective practices, but each culture will have a unique set of practices that collectively constitute its own science.

### Mātauranga Māori

Williams’ (1971) dictionary provides no mention or definition of “mātauranga”, but its three

definitions of the stem *mātau* are: 1. Know, 2. Understand, 3. Feel certain of. *Mātauranga* is generally thus taken to mean “knowledge”, and *mātauranga Māori* refers to knowledge that is specific to Māori. The Waitangi Tribunal (2011) describes it thus in its final report, *Ko Aotearoa Tēnei*: “the Wai 262 claim is really a claim about *mātauranga Māori*—that is, the unique Māori way of viewing the world, encompassing both traditional knowledge and culture” (p. xxiii). Royal (2009) expounds upon its pedigree by mentioning its use, at one time, for biblical knowledge.

*Mātauranga Māori* has been described in many ways and has some aspects that are indefinable; nonetheless a principal descriptive component of *mātauranga* is *whakapapa* (genealogy or taxonomy). The epistemological building blocks of *mātauranga* are found in cosmological *whakapapa* (Royal, 1998b, 2008, 2009). Others suggest *whakapapa* as a device for organising phenomenological knowledge in place:

To Maori, “to know” something is to locate it in space and in time ... Fundamental to this ability to locate a thing in time and space is knowledge of its *whakapapa*—its genealogy or lines of descent ... By locating things in time and place, *whakapapa* also functions as a “mental map”, analogous to but in contrast with the “knowledge as landscape” metaphor. (Roberts & Wills, 1998, pp. 45–46)

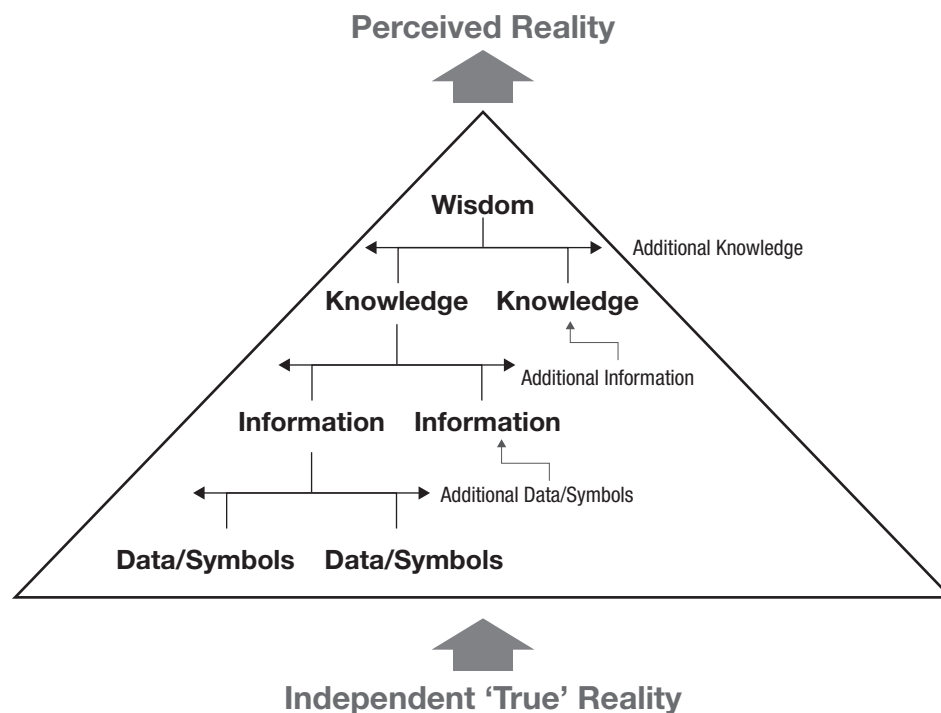
Graham (2009) argues that *whakapapa* is also generative, a paradigm that enables one to attain new knowledge by recognising and reproducing patterns in *whakapapa*. Human knowledge comes from symbols (data) that represent objects’ reality, and knowing the *whakapapa* of these symbols leads to information, knowledge and understanding in *mātauranga*. However, in *mātauranga*, knowledge creation is modelled by a non-human force in the cosmological *whakapapa* (Royal, 1998b, p. 5). Thus, knowledge in *mātauranga Māori* is

acknowledged to be at times outside the scope of human knowledge. Through understanding and extrapolating *whakapapa* connections of data and information, our ancestors built up knowledge and understanding of their world. In *mātauranga*, *whakapapa* characterises the key connection that enables *mātauranga Māori* to generate knowledge, in the way that the DIKW pyramid can be seen as a knowledge production model.

### The DIKW prism

Although brief, the descriptions of DIKW, science, *mātauranga* and *whakapapa* presented above provide a basis for comparative analysis and in this section we bring those discussions together. Understanding connections between data, knowledge and information to produce higher order comprehension is a common goal of knowledge systems, and visually juxtaposing the *whakapapa* of knowledge that generates *mātauranga* (see Figure 2) illuminates the work of the DIKW pyramid.

A key concept of *whakapapa* is that all things are derived from the union of two or more things, or what Royal (1998a) called antecedent, parental phenomena. Drawing on this notion, each successive layer of the pyramid can be considered the progeny of the preceding layer. This relationship is presented going from bottom upwards in Figure 2, in contrast with the more conventional presentation of *whakapapa* descending down the page. We acknowledge that a reductive step of identifying comparable data and symbols is needed—match-making if you will—as only the meaningful juxtaposition of data will produce a generative piece of information. In Royal’s description of *mātauranga*, knowledge is based upon the interpretation of symbols and is seen as the descendent of ignorance (1998b, p. 5), a naïve position in which the observer sees only data, without making connections. Through the understanding of *whakapapa* connections between data



**FIGURE 2** This Data-Information-Knowledge-Wisdom (DIKW) pyramid invokes whakapapa to make logical connections between organised data to produce information, and organised information to produce knowledge. The DIKW hierarchy can be seen to produce a “perceived reality” from elements of an “independent true reality”.

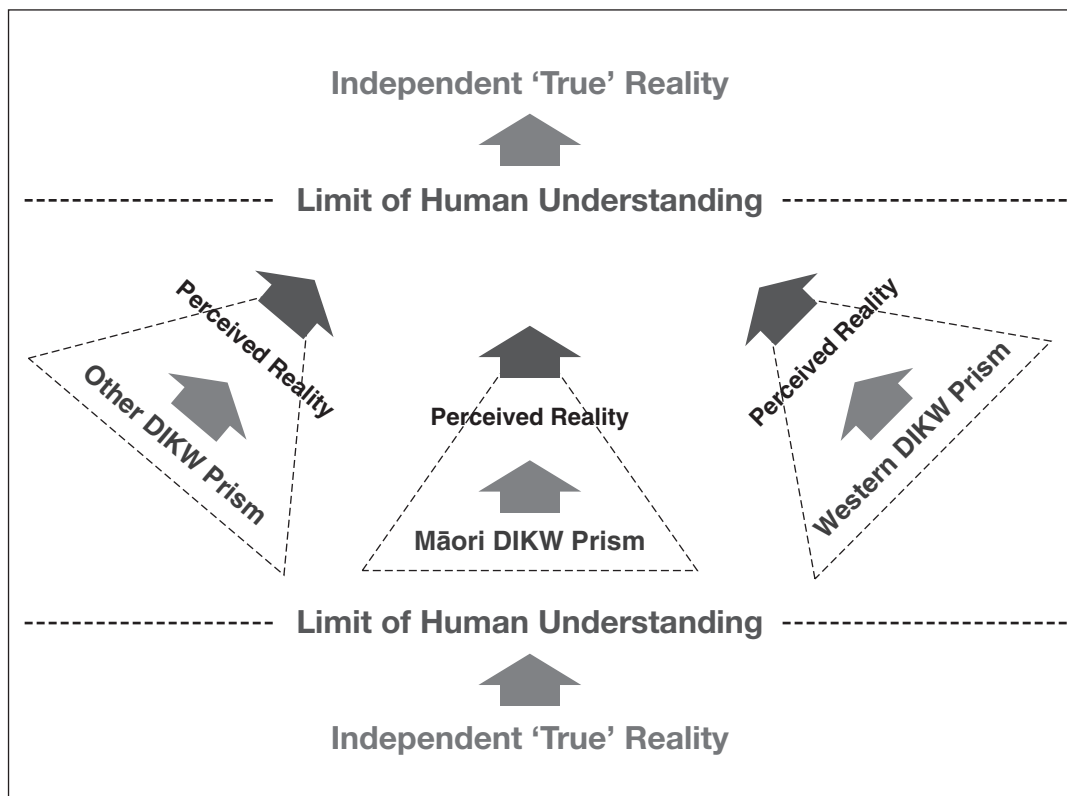
(symbols), information, and knowledge one is able to attain wisdom. The progression from data to wisdom thus invokes and embodies a form of intellectual whakapapa. Movement within the pyramid relies on baseline assumptions and practices, and each knowledge system will thus arrive at a different “perceived reality” based upon a socialised interpretation of “independent true reality”.

The diagram in Figure 3 extends this idea by depicting the limits of the DIKW lens, highlighting the inability of humans to cross beyond the limit of human comprehension and understanding. The knowledge we gain about the world is bound by whatever conventions, tools, technology and understanding that we are using as a culture at any given time. Different cultures will have different ways of gaining knowledge, and together these define the realm of human science. This model is effective for conceptualising the breadth of empirical human comprehension but falls short of capturing the esoteric.

The pyramid fails to account for components of mātauranga that lie beyond the scope of empirical human understanding. However, if the DIKW pyramid is treated as a cultural filter, it is possible to account for cultural differences in the interpretation of the empirical and observable. We discuss this idea next.

### Through the looking glass

People perceive reality differently because they see the world through a filter that is the product of their cultural paradigms (Roberts, 1996), or the baseline assumptions that that culture’s knowledge system requires to function. When addressing the concepts of independent “true” reality and perceived reality the DIKW pyramid is more usefully employed when combined with the theory-dependence of observation (TDO) notion. Roberts’ version of this states that perceived reality differs from true reality

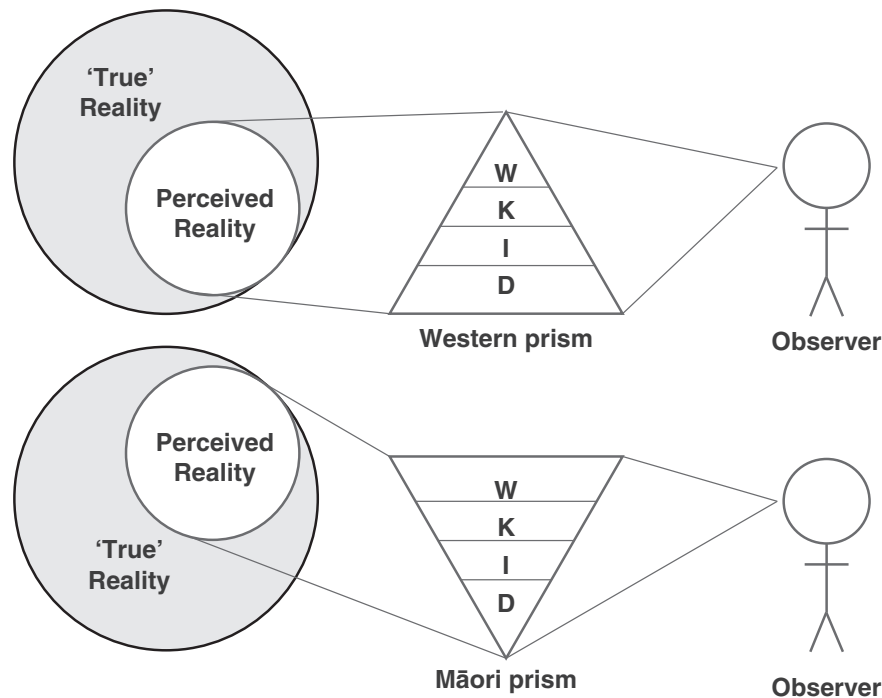


**FIGURE 3** Data-Information-Knowledge-Wisdom (DIKW) pyramids produce different perceptions of reality depending on the knowledge-producing conventions of the culture from whence they come. This diagram highlights the limits of human understanding that define the operational realms of DIKW pyramids.

due to cultural paradigms that form a “cultural filter” (1996, p. 60). All human knowledge systems are subject to observational prejudice. Western science and its arsenal of “objective” knowledge-producing practices is no exception. The DIKW pyramid, as an analogue for human comprehension built upon different cultural paradigms and sets of knowledge-generating practices can be understood as a refractive lens within the TDO model. In physical terms, the material and dimensions of the refractive lens, or “prism”, give rise to a unique “refractive index”, which we argue describes the cultural practices that perceive and interpret data. The unique connections drawn between data and knowledge for a given DIKW prism depend on its refractive index: interpretations of data are bent to some degree or other depending on this index. We acknowledge Te Maire Tau’s argument that mātauranga and whakapapa

presented a kind of “mirror knowledge” (2001, p. 138), which reflected more about the observer than what was observed, but we prefer the refractive lens, or prism, analogy, because it reminds us that Māori were actively looking outwards, not inwards, to understand their natural world. It also invites us to consider the mechanisms by which people understand the external world, and how these can be embodied by a cultural refractive index.

The union of TDO and Ackoff’s DIKW pyramid, illustrated in Figure 3, visually conceptualises the relationships between true reality, perceived reality, cultural paradigms, and the observer. Reality represents everything that can (and cannot) be perceived by every imaginable method. The zone denoted as perceived reality in Figure 3 is the area that an observer looking through a cultural lens is able to perceive, given the filtering and refracting effect of any



**FIGURE 4** Data-Information-Knowledge-Wisdom (DIKW) pyramids act as prisms, refracting “true independent reality” into “perceived reality”. Different cultures process data and information differently and “see” different things. A mātauranga Māori prism that privileges wisdom will give a perceived reality that has similarities to, but important differences from, a Western science prism.

given DIKW pyramid/s. The pyramid thus acts to define the limits of human comprehension in a knowledge system, resulting in an observer’s lens-bound look distorting an independent “objective” reality into their perceived reality. The model reveals zones of comprehension that lie outside human perception. Because different cultural paradigms give us refracted views of reality, phenomenological explanations can differ substantially between cultures, disciplines and even fields of enquiry.

### Beyond the looking glass

In mātauranga, knowledge comes from a source outside of human hands and that knowledge is unattainable except through an intermediary such as symbols (Royal, 1998b). These paradigms infer that knowledge of all things, of an independent “true” reality, is unattainable by people. Mātauranga thus readily acknowledges

the limits of human perception. Comprehension of objective “true” reality is only available to atua (gods).

By contrast, the Western scientific approach strives to perceive all of reality, which would require perception and comprehension of the entire universe instantaneously: an impossible feat, even by Western science’s own standards. For instance, the Heisenberg Uncertainty Principle describes the quantum impossibility of fully knowing the mechanics of subatomic particles. The world is thus not fully knowable, only predictable, in probabilistic terms devised by Niels Bohr and Albert Einstein.

As mentioned earlier, DIK’s approach favours measurement. However, to answer Frické’s criticism, the W of DIKW may work for the epistemological aspects of mātauranga Māori that cannot be quantified or measured. According to Hemi Toia, Pū is basically the root, cause, or the reason behind. It chimes with the Māori idea that all that happens in



the physical world first happens in the spiritual world “ki tua o te ārai”, or “beyond the veil”, or in our own terms “beyond the limits of human comprehension”. Pū encompasses the philosophical, spiritual and psychological connotations behind a word, object or action and Kē is its operational usage, form or the action itself. Pū and Kē are often referred to as a way of illustrating the relationship between the historical and contemporary. For example, when someone commits an act (Kē) of murder we could observe the action, we can measure its effects, but we would be hard pressed to comprehend the reason or root cause (Pū) for the action. We can have aroha, or sympathy, for the murderer, but we could never put such a complex myriad of information, feelings, psychological and physiological drivers of the murderer’s history into a box to predict the outcome of murder. We would be hard pressed to find two parental phenomena for the outcome, although a whakapapa network of antecedent phenomena may draw us closer. Yet, in the absence of these drivers, would the act have occurred?

Pū and Kē co-exist and cannot be understood apart from each other, but operationalism introduces a dichotomy by stating that one is knowable and one unknowable. Operationalism only recognises the observable Kē without considering that which is not measurable, the Pū, known only in essence. As far as operationalism (and the DIK(W) pyramid) Pū may as well not exist, as it cannot be empirically or deductively conceived of.

As with Pū and Kē, we may more severely limit the DIK(W) pyramid’s application to mātauranga by recalling the distinction made between kauwae runga and kauwae raro curriculum in the *whare wānanga* (Best, 1923). *Kauwae runga* can be said to pertain to the esoteric and supernatural, and *kauwae raro* to the natural and social. It may make some sense to consider how DIK(W) explains phenomena in the natural and social worlds, as it is designed to deal with observable phenomena,

but it probably has little, if any, relevance to the spiritual realms. Similarly, in considering *ngā kete e toru*, whose mātauranga enlightened Te Ao Mārama, we consider that DIK(W) may enliven discussions around Te Kete Aronui knowledge, again, as this kete deals primarily with natural, observable phenomena, but it would add little to discussions on Te Kete Tuauri and Te Kete Tua-ātea knowledge.

This tension may be resolved by considering Georgina Stewart’s superset model (2007). In this, rather than seeing an area of common ground between Western science and mātauranga, she conceives a model in which Western science is a subset of mātauranga. Western science is not able to philosophically and epistemologically accept all of the processes and practices that characterise mātauranga. However, there is nothing in Western science that mātauranga Māori is philosophically unable to accept or accomplish. The epistemological boundaries of mātauranga, therefore, are wider than those of Western science and Western science can be seen as a subset of mātauranga Māori.

The tension may also be alleviated by reconsidering how the W of the DIKW may draw upon the *kauwae runga*, or the Pū, in order to make sense of organised data, information and knowledge. We turn to this idea next.

### **Transmission of mātauranga Māori: Reorienting the DIKW pyramid**

While data is important to knowledge transmission in an oral culture (some *kaumātua* were famed for their ability to recite reams of *whakapapa*), mnemonics that enable one to retrace connections between data become all-important recall devices if data are to be stored, remembered and passed on. Rather than the brute force storage of data enabled by computers (which might record the numerical coordinates of every *karaka* tree), the *tohunga* remembered how data are embedded in a matrix

of other knowledge (such as noting that karaka trees grow at certain intervals along the coast). Thus, data takes on less significance than wisdom in mātauranga Māori.

Tā Moko is a “taonga work” (The Waitangi Tribunal, 2011) of traditional mātauranga Māori that is only appropriately worn by select people. Tā Moko artist Mark Kōpua has revived and developed a tradition of “kirituhi” from the precedent set in the legend of Mataora and Niwareka (Kopua, 2006). In this, his practice of tattooing Māori designs on parts of the body besides the face, and for non-Māori people, is seen as mātauranga Māori—a taonga work of contemporary times. The tribal oral history he drew upon for the term “kirituhi” was an example of drawing a practical precedent from wisdom embedded in pūrākau. The “precedent aspect” has been argued to be a way to revive not just mātauranga Māori, but also a Māori outlook or philosophy on contemporary issues (Mead, 2003, pp. 343–344).

In this example, pūrākau and oral histories can be seen simultaneously as data, and encoded knowledge, and a capsule of wisdom, when known, so is a repository for context-specific information and data. Wisdom is extracted through an understanding of the data in context.

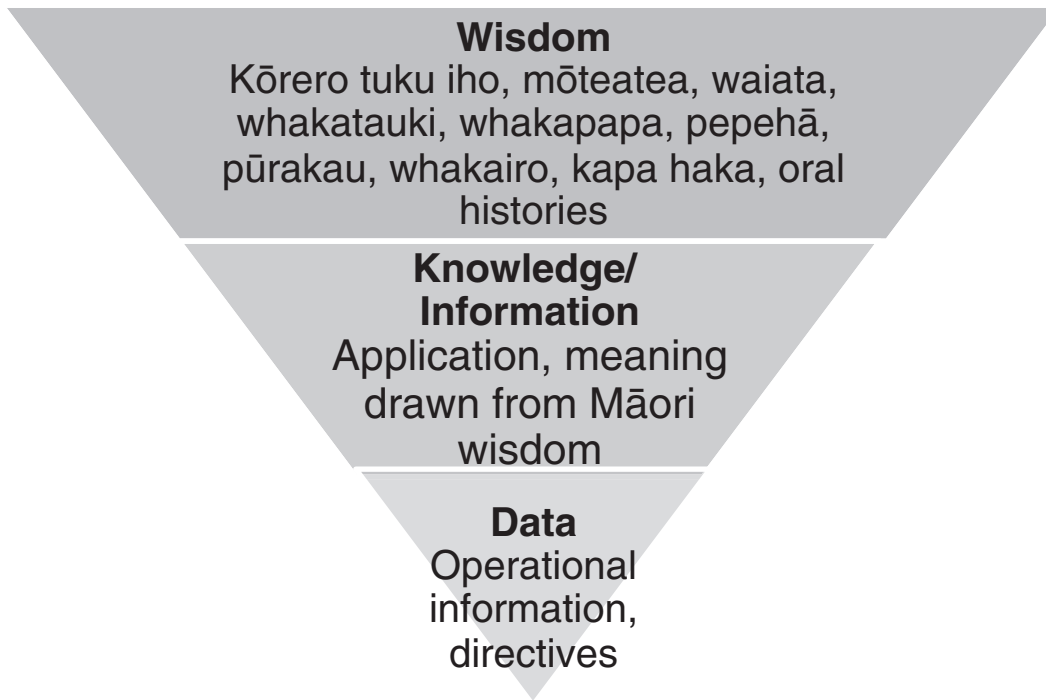
From a survey of information systems and knowledge management textbooks that employ the DIKW paradigm, Rowley (2007) found that there is no common agreement on the “nature of the processes that convert data into information, and information into knowledge, to the extent that it is not clear whether there are in fact three distinct concepts” (p. 174). The separation between information and knowledge is difficult to define, so for simplicity in the ensuing discussion we conflate information and knowledge, arguing that there are just three distinct divisions: data, information and knowledge, and wisdom. We bring the idea of the DIKW prism to bear by stating that one person’s data (say, a string of Roman characters arranged into Māori words) can be another’s

wisdom, depending upon the refractive index of the prism through which they can observe.

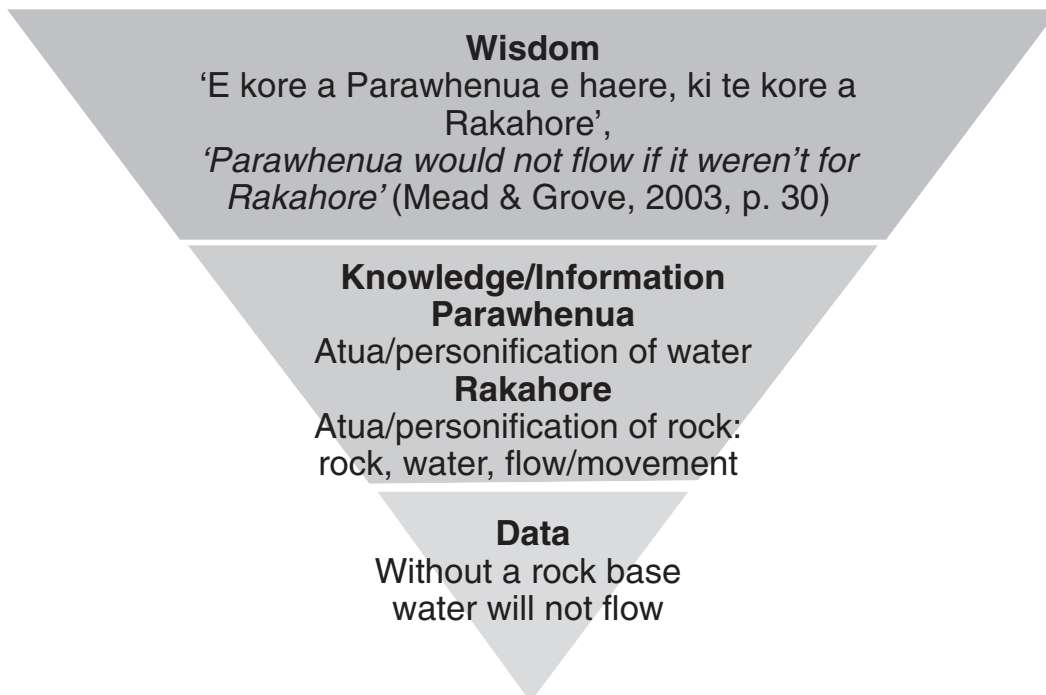
Figure 5 presents an upended DIKW triangle (foreshadowed by the diagram in Figure 4) that highlights the abundance of Māori wisdom (interpreted by the non-knower as *data*) in forms such as kōrero tuku iho, mōteatea, oriori, whakataukī, pepeha, physical Māori media such as whakairo, tukutuku, tāniko, kōwhaiwhai, raranga, performance such as kapa haka and waiata ā-ringa, pūrākau and oral histories. While some of these forms have been abstracted from their original expression through publications using the written word, access to wisdom and the knowledge therein was traditionally, and is often still, only available through living human repositories such as kaumātua. In the oral sharing of wisdom, Māori understand that a mauri is being passed on and enlivened. It is not just the knowledge as a commodity itself that is important, with wisdom being seen as a kind of code to be cracked, but the relationship maintained and invigorated in the act of sharing wisdom (Simpson, 2004). An example is given in Figure 6 of how knowledge/information and data can be extracted from a particular whakataukī. This is about personifying natural processes in order to retain otherwise functional (and sometimes rather tedious) information and data within an oral tradition.

*Knowledge* and *information* can respectively be seen as “know how” and “know what” (Zeleny, 1987), whether in the context of mātauranga Māori or knowledge management systems. In mātauranga, being able to understand and contextualise kōrero tuku iho gives instructions for living. For instance, knowing *how* a piece of wisdom applies to a social situation is different to knowing *what* to do in that given situation.

Kōrero tuku iho contain the essence of something’s qualities. Tāne-nui-a-Rangi was said to have imbued certain trees with fire (wisdom). These rākau were specific types of trees used in creating fire (knowledge and information).



**FIGURE 5** This upended version of the Data-Information-Knowledge-Wisdom (DIKW) hierarchy represents a mātauranga Māori perspective on the relative prevalence of wisdom, knowledge/information and data. Wise words, forms and media were used as vehicles for delivering knowledge, information and data, rather than the other way around.



**FIGURE 6** At face value, this whakataukī (proverb) appears to be about the characteristics of atua, but reveals information and data about the natural world embedded within.

In an oral tradition this type of storytelling was essential to ensure the long-term survival of information. The more outrageous, funny or unbelievable the story, the easier it was to remember. The original teller of the story had to synthesise data, information and knowledge in such a way that it could all be packaged and conveyed as wisdom, ready to be unpacked by the hearer. It was the recipient of these stories who had to ask themselves “He aha te Pū, he aha te mauri o tēnei kōrero?” (What is the purpose and meaning behind this story?) and thereby extract knowledge, information and data that could be operationalised in the day-to-day activity of (say) building a fire.

Compared to wisdom, knowledge and information have less significance in the schema of Figures 5 and 6 and data the least significance of all. Nonetheless, as with any whakapapa, data is an important descendant of its antecedent phenomena. So if the DIKW pyramid is a way to organise data and information to produce knowledge, then this variation is a way to understand the reverse process that draws knowledge, information and data from wisdom, for the contexts of practically using wisdom and for the revitalisation of mātauranga.

## Conclusion

The DIKW pyramid provides a model of human comprehension that, when recast, can work for mātauranga Māori in different ways. The common ground between the DIKW hierarchy and the knowledge whakapapa in mātauranga is that both attain wisdom through the interpretation of symbols (data) and their interconnection. In the DIKW prism model, we re-imagine the “common ground” between knowledge systems as a product of a culturally refracted view upon an independent “true” reality. Different cultural perceptions of reality are produced by the unique set of practices that make up the refractive index of the cultural lens that is a culture’s way of making meaning between data,

information, knowledge and wisdom.

We then discussed some of the practices that might characterise mātauranga Māori’s unique DIKW prism. We argued for a similarity between DIKW and the whakapapa approach to generation of mātauranga, arguing in addition that the knowledge (mātauranga) and understanding (mōhiotanga) that emerges through connections between data and information aligns with an Oxford definition of science. Thinking of mātauranga in a revitalisation context invited us to “upend” the DIKW pyramid, and argue that Māori wisdom is of greater importance in the making of meaning in an oral culture, and arguably exists in greater volume than data. This is partly because of the efficient use of data in the human mind, which looks to make connections between data to aid remembering. The DIKW pyramid for mātauranga looks and functions differently from that in knowledge management and information science.

There are limits to our approach. Does it make sense to examine aspects of mātauranga (such as *kauwae raro*) in isolation from other, interconnected, facets of it (such as *kauwae runga*)? Knowledge of the natural world, *te kauwae raro*, may well be described by DIKW’s operationalism and inductivism, and *te kauwae runga* can be classed as -W, but what of the connection between the two parts of the pyramid? This could be further explored by looking at a specific mātauranga-science “interface” project, giving greater specificity to our discussion, but it is beyond the scope of the current paper.

Limits aside, this thought exercise has illuminated ways in which the DIKW hierarchy can be understood in the context of mātauranga Māori. It answers claims that mātauranga Māori cannot explain the world, by instead adapting and incorporating ideas and ways of seeing that help us to better see the relevance of mātauranga in an information age.

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