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The Data/Information/Knowledge/Wisdom Hierarchy Goes to Seminary

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Introduction

The value of the Data – Information – Knowledge – Wisdom (DIKW) hierarchy, an apparently intuitive visual, conventionally used in information science and knowledge management pedagogy to define the terms in question, has recently been challenged (Frické, 2008; Rowley, 2007). A rigorous application of the DIKW hierarchy in the widely diverse domains of academic research has proven difficult. There are several possible reasons for this ambiguity.

1. In everyday language usage, the terms are polyvalent in meaning. Speech conventions using the terms can trump any precise definition of the terms in most any context.

2. Simple examples used in DIKW pedagogy do not reflect complex communication patterns in real-life settings. Context clues are necessary to make sense of the terms.

3. The social aspects of information flow are fluid, muddying any transitions between categories. In many contexts, the terms are synonymous with a non-specific generalization such as "stuff."

4. The terms carry long-standing baggage in rhetoric. At times, claims and assertions use the terms as a form of validation when such trust is unwarranted. The conventional canons of information literacy and critical thinking foster skepticism with regard to such claims.

Literature Review

Ackoff (1989) is attributed with the first application of the hierarchy in knowledge management practice. In a presidential address to the International Society for General Systems Research, an audience primarily consisting of engineers, he used the hierarchy to distinguish

between what computer systems can do, and what is uniquely human. So information systems can organize data and make it accessible, and knowledge systems can apply information to specific tasks, and since these systems rely on logic, "these can be programmed and automated." However,

> wisdom-generating systems are ones that man will never be able to assign to automata. It may well be that wisdom, which is essential to the effective pursuit of ideals, and the pursuit of ideals itself, are the characteristics that differentiate man from machines. (p. 9)

In Ackoff's context, given his conclusions, the definitions and distinctions he makes are warranted. The hierarchy, later diagrammed as a pyramid, was then incorporated into similar systems-intensive disciplines, including information science. Within this field, the pyramid has seemed useful in the emerging pedagogy of information literacy. What may have been for Ackoff a context specific, conversation specific construct with a delimited intention has since then begun to be a much more broadly applied narrative, with some hinting that it might even be considered a metanarrative.

Rowley (2007) provides a comprehensive review of the library science literature that refers to DIKW and catalogs the varying definitions provided for each of the elements. In conclusion she notes significant ambiguity in the relationships between the elements, and that "wisdom is a neglected concept in in the knowledge management and information systems literature." (p. 178). As will be discussed later, this follows the pattern suggested in the model in which these disciplines are information driven.

Frické (2008) continues the critique by arguing that the notion of data in relationship to information is fatally flawed. According to one argument, to infer information from data assumes the truthfulness of the data and concludes that the inferences must then be also true. This inductive assumption cannot be sustained. Also, he argues that there is not "a special category of

'data' which can serve as the bedrock for all else." (p. 136). Thus the hierarchy is without foundation.

Model versus Narrative

I wish to draw a line between narrative and model. The narrative claims to define and describe reality with a high level of certainty and is applicable in all contexts. As such "data" and the other terms in DIKW would have a definition and application that pertains universally. Thus if the narrative should fail in any one context, it then ceases to be a credible narrative in any context. On the other hand, a model is a minimalist beginning point that serves only to initiate conversation. If it does not prove useful in one context, that in itself is a valuable outcome, and yet it may still provide useful insights in other contexts. Narratives tend to be foundational holistic, and static, losing credibility if demonstrated to be false on any point or level. Models can be dissected, parsed, tested, turned upside down and inside out, tweaked and rebuilt as needed, and still serve the modest purposes for which it is intended. This is informed by models as used in science, succinctly defined by Mansnerus (2011) in which "integrative modelling practices produce models that are specifically *tailored* – built, used and applied for explicit purposes, in particular, for answering specific research questions in interdisciplinary communities." (p. 379).

While readily conceding the weaknesses of the DIKW hierarchy as an ontological disciplinary "narrative" as expounded by Rowley and Frické, I still wish to explore the usefulness of a simple "model" of the DIKW construct in one narrowly delimited explicit pedagogical context—a research methods class. When students are sent to the campus library to find "information," it is hoped this model can assist them in determining that they have found the

object of their quest, providing a basis for evaluating this discovery, and using the documentary content in the term paper. These skills are a facet of information literacy instruction.

Further, I wish to frame the discussion within the context of the Protestant Seminary curriculum. In the discussion of "research methods," the Seminary curriculum includes a diverse spectrum, including field work in archaeology, social science approaches to congregational practices, biblical exegesis, Church history, and systematic theology. Conventionally, each sub-discipline has had its own understanding of what constitutes research methods. This model is an attempt to account for that diversity, not seeking to homogenize them. It has been anecdotally observed that successful students tacitly understand this methodological diversity and flexibly adapt from assignment to assignment. However, for the sake of clarity in formal "research methods" pedagogy, I wish to succinctly illustrate those distinctions by using this DIKW "model."

Definitions

Both Rowley and Frické have expounded on the ambiguities inherent in the definitions of DIKW and found this problematic to the point of questioning the usefulness of the narrative, even within the discipline of information science. By contrast, this model anticipates narrowly defined terms in a sharply delimited context. Some of this focus may be somewhat obscured by an attendant necessity; in order for the definitions to fit in a Table, captions or tags are required, and I am fully aware that these may not eliminate ambiguities.

The friendliest of the four terms is "information." Information literacy refers to information-seeking behaviors, information-seeking strategies, and information sources. Given the context in which the student writing a term paper for a class is sent to the campus library to find "information," and that the pertinent sources of information to be found in such a library are

in the form of commodified and reified documents, in this model "information" is delimited to the intellectual content of these commodified and reified documents. Students are seeking documentary information found in texts, regardless of the communication technology employed in reifying and then accessing those texts.

Data may be inferred from the information, and one way or another, depending on the discipline, it should be verifiable. Some research methods work inductively from data to form conclusions; other methods deduce the data from the conclusions.

Defining knowledge is also problematic. Epistemologists will never run out of issues to debate, so I will use as a "caption" the classical definition of knowledge: "justified true belief."

Drawing on terminology coined by Lyotard (1984), I suggest that wisdom be tagged as "knowledge legitimized by performativity." Justified true beliefs find expression in action, and these actions can then be evaluated and assessed.

To summarize, the data are the ingredients (flour, salt, yeast, water, sugar, etc.); information is the loaf of bread baked using the ingredients; knowledge is analogous to the eating and digesting the bread; and wisdom is getting stuff done with the energy derived from the bread. Even so, while neat and of some use, this metaphor cannot be made to carry much weight.

Disciplinary Paradigms

The conventional graphic for DIKW is a pyramid. Rowley (2007) illustrates several other graphics that are equally interesting.

Conventional Hierarchy
Rowley, 164.
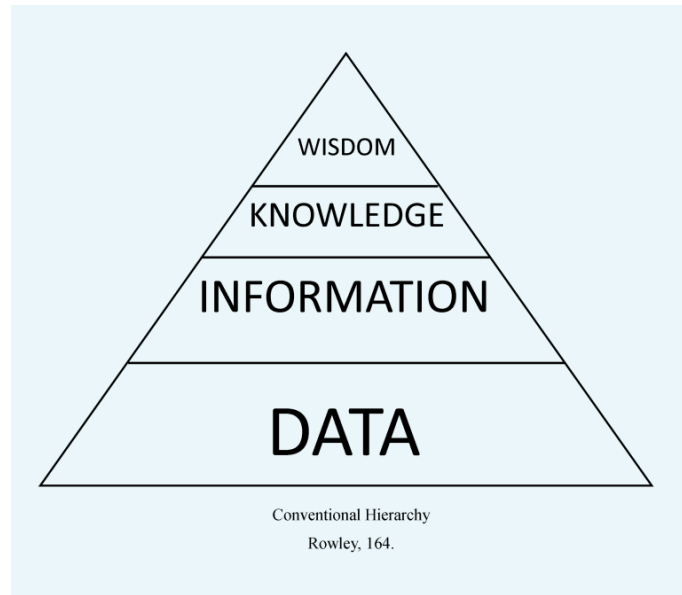
I am suggesting yet another, in which DIKW is visualized as four parallel fields, reminiscent of my grandfather's farm in the western prairies. Each of the sub-disciplines of the Protestant Seminary is primarily situated in one of the fields, as indicated by what counts as primary sources.

These fields are separated by paths, not fences. While the immediate boundaries of the field in which the inquirer is situated may be reasonably obvious and intuitive, the far boundary of an adjacent field is less clear and perhaps even indistinguishable. This imagery accounts for the mind set of disciplinary practitioners when discussing methodologies of other disciplines, and has been described as a disciplinary silo.

FIELDS OF RESEARCH MODEL

GENERAL CATEGORIES	SCIENCES	SOCIAL SCIENCES	HUMANITIES	ABSTRACT
SEMINARY CORRELATE	ARCHEOLOGY	MINISTRY EDUCATION	EXEGESIS HISTORY	SYSTEMATIC THEOLOGY
FIELD NAME	DATA DRIVEN	INFORMATION DRIVEN	KNOWLEDGE DRIVEN	WISDOM DRIVEN
Definitions	Raw Materials of Study	Articulated Reified Communication	Justified True Belief	Knowledge Legitimized Through Performativity

Field	data	information	knowledge	wisdom
1. Archeology	Artifacts	Field Reports	Correlation with history	Out of sight
2. Ministry	Survey Responses	Statistical analyses	Understanding	Application
3. Exegesis/ History	Inferred at second hand	Texts authored by agents	Hermeneutics	Transformation
4. Theology/ Philosophy	Out of sight	Texts authored by agents	Rhetorical and analytical methods	Transcendence as characterized by faith, hope and love
Disposition	Critical Thinking ⟶		Discernment ⟶	
Action	Verification	Validation	Justification	Valuation

In the context of information literacy pedagogy, when a secondary researcher, (in this case, a student writing a term paper) seeks information, it is a standard convention that primary sources are the most essential forms of documentation. The paper thesis passes or fails based on the appropriate understanding of primary sources. Secondary literatures serve to further the analysis and discussion of the topic in hand, and can contribute to a better understanding of the primary sources (not necessarily ontological truth). Their usefulness need not be discounted, but nonetheless, they cannot replace primary sources in competent term paper authorship. Tertiary sources serve best as surrogates for prior knowledge allowing the novice in a topic to efficiently

make sense of the primary and secondary sources. To this end, the model has an explanatory function pertinent for a pre-reading classification and evaluation of documents found in a library-based search for sources for typical class term papers.

Any discussion of "quality" primary sources is inherent in the selection of the topic and appropriate method. The pre-reading evaluation to determine quality secondary and tertiary sources is largely instrumental, relying on the authority of the author, publisher, or journal and the level of editorial/peer review; and secondarily, the professional competence of the presentation. This kind of knowledge about the sources is readily available when mediated by the library, but may be more difficult to assess in open publishing forums such as the internet.

Field 1: Archaeological Research

Archaeology as a discipline is paradigmatic of data-driven research. In other words, the basic unit upon which the discipline is constructed is the "artifact." The artifact is a physical object which can be independently measured and described by any number of human observers, and it can be anticipated that the descriptions will concur. The primary venue for original research in archaeology is in the field, on location at the archaeological site. Careful methods of digging for and documenting finds are crucial. Analysis and discovery of something new by a researcher engage the objects found directly. This is the pertinent data. The future of archaeological research is ensured because there are many unexplored historical sites and new emerging tools allow for more accurate analysis of artifacts.

On campus, in the library, the secondary researcher relies on published field reports, which can be viewed as the expert testimony of a primary researcher who has personally handled the artifacts. As such, the field reports serve as the primary literatures and are evaluated by the reader according to criteria of accuracy and completeness. If warranted, the reported "findings"

can be verified by examining the artifact in person and/or visiting the original site where it was found. In the DIKW field model, the boundary between data and information is clear and unambiguous: artifact / report.

This information can then be drawn upon to corroborate or critique prior knowledge about relevant history or places. But it is only through the filters of other forms of historical research that archaeological data can be fully appreciated; thus the value of the archaeological data for the discipline is codependent on other historical knowledge, such as will be described in field 3 below. In the DIKW field model, because the boundary between information and knowledge is one step removed from the data, the perception of when information becomes knowledge is less intuitive. As for the boundary between knowledge and wisdom, between justified true beliefs and knowledge legitimized by performativity, the original data is so fully integrated and embedded in other forms of historical and documentary research that the boundary is virtually out of sight. While a connection between the artifact and transformed living might be inferred, it is not a straight line.

Summary: Primary sources for campus based research include the site field reports. The desired contribution to knowledge outcomes correlates findings with historical documents.

Field 2: Social Science Research in Christian Ministry and Education

Research in Christian ministry, religious education, and related areas is paradigmatic of information-driven disciplines. The various quantitative/qualitative methods developed in the social sciences dominate research in the field. The initial reporting documentation derived from the research usually represents the findings statistically. If questions about the results warrant further analysis, later reviewers do not attempt to verify the original survey answers and interview responses, but rather to validate the instruments, sample size, and statistical models

used in the study. If done according to best practices, it should be impossible to trace which participant gave response A in instrument X. The information in hand is one step removed from the data, which is no longer accessible. However, according to the field model, the boundary between data and information remains intuitive and obvious.

On campus, in the library, the secondary researcher must rely not on the data proper, but on published research findings, frequently in the form of journal articles. These, nonetheless, function as the documented expert testimony of a primary researcher. As such, these research reports are classed as the primary literatures, and are evaluated according to methodological validity. Discussions and applications of the findings by others than the original researchers constitute secondary literatures. So far, the distinction between archaeology and ministry research methods is limited to the difference in direct access that the secondary researcher has to the original data.

One further distinction is needed to identify the border on the other side of the field. The goal of archaeological research is a form of "knowledge-that." The conclusions are expressed in the form of indicative assertions. Social science research intends a different outcome, namely, "knowledge how." Findings are intended to inform action. Thus the conclusions are expressed in a form of imperative assertions. The boundary between information and the "knowledge-how" actions is intuitive and obvious. Since this is the way things are, this is how things should be done. However, from the perspective of the secondary researcher, the connection between the way things are, what should be done about it, and whether or not that way of doing can be generalized to other contexts is still somewhat vague and will require further experience. This observation ensures there will always be room for more research using these methods.

Summary: Primary sources for campus-based research include the published reports of primary researchers. The desired contribution to knowledge outcomes correlates findings with professional practice.

Field 3: Humanities Research in Biblical Studies and Church History

Literature-based research is paradigmatic of knowledge-driven disciplines. In the Seminary curriculum, this would encompass Biblical Studies and Church History. The information incorporated in the documents accessed in the research process is an expression of what the document author knows. The document reports her observations, beliefs, understandings, interpretations, and responses to her lived experience. The secondary researcher does not have the option to travel back in time and live the situation for herself so as to either verify or validate the accuracy of the claims. Data, as used in this model, are not accessible directly, but only as filtered and communicated by an interpreter. Thus the secondary researcher must exercise discernment in evaluating the reliability and authority of the source and through inference become more or less confident about what happened. Beliefs formed through this research process must be justified through corroboration and logical inference.

One way to distinguish between the methods of literary analysis and historical research, conventions for biblical exegesis and church history, is to illustrate by referring to two literary detectives: Sherlock Holmes and Maigret. Sherlock Holmes walks into the scene of the crime and, through keen observation, notices what apparently seem to be trivial details that others have overlooked, and from these he is able to deduce the solution to the mystery. Thus, the biblical exegete, through keen analysis of the text and a sound understanding of the context, notices something overlooked or unappreciated by previous scholars, and thus contributes to the interpretation of the text. Maigret, on the other hand, embeds himself in the situation, asking

questions, observing the characters. When asked, he responds, "I don't know anything yet." Bit by bit, piece by piece, the solution to the mystery becomes evident. Thus the church historian, by asking questions of the key witnesses, bit by bit, pieces together a picture of what happened.

In biblical exegesis, the secondary researcher begins by examining the text, and through the use of tertiary tools, such as lexicons and grammars, comes to an understanding of the text. Then this is reexamined in conversation with other exegetes, both ancient and recent. This works because the primary text is established and discrete and has an implied authority.

In Church History, the available documentation from most eras, from the earliest church fathers through the Reformation, and on down to the present, is immense. Thus the secondary researcher can turn to recent scholars to help identify significant foundational documents as primary and authoritative. With the improved access to other historically contemporary documents that has emerged with digitization initiatives, there will be expanding opportunities for finding additional documentary evidence for historical events. However, caution is in order, because 15th century discredited disinformation most likely will not become legitimized only because of time. On the other hand, the use of disinformation in the 15th century is a potentially interesting topic.

The boundary between information and knowledge is obvious, and the boundary between knowledge and wisdom is equally intuitive. Once something is believed and known, rather than as information objectively held, a transformation takes place in how life is lived and how future interactions with new information is processed. Successfully using the knowledge to accomplish desired ends is wisdom. In the case of Biblical studies, one example of the interplay between text and meaning is described as a "hermeneutical spiral." (Osborne, 2006).

Summary: Primary sources for campus based research include the documented testimony of historical authors. The desired contribution to knowledge outcomes is transformative learning (Budd, 2009) that points towards a fuller understanding of reality and truth within an historical context and correlates that to reality and truth today.

Field 4: Abstract Methods and Systematic Theology

The last field in the DIKW model is that labeled "Wisdom." For purposes of the model, this field represents those disciplines in which method applied to answering open questions takes precedence (Floridi, 2013). In the Seminary curriculum, systematic theology is paradigmatic for this field.

The focus of study is not texts or events, but themes, systems of thought, worldviews, and the like. The standard subdivisions of theology include soteriology, eschatology, pneumatology, and any number of other –ologies. Methods include the comparing and contrasting, the analysis and synthesis, of ideas held by others within the designated –ology or –ism. Conclusions define value and give meaning to lived experience. Vocabulary to caption this is inevitably problematic, so I chose "transcendence" in that it encompasses some of the vision, as Adler (1986) uses it to describe history and philosophy, "a transcendental form of learning and even reflexively applicable to itself." (p. 129). The caption fits in this model when framing its definition within the Pauline virtues of faith, hope, and love (1 Cor 13:13) and when leaving aside some of its mystical associations.

Like literary sleuth, Hercule Poirot, method is the key to solving the mystery. Determining the method used by the perpetrator will lead to unmasking the criminal. In systematic theology, one standard approach for the secondary researcher is to focus on a canon of recognized dialectics, for example, Arianism versus trinitarianism, or Arminianism versus

Calvinism. By comparing and contrasting the rhetorical methods, assumptions, and contexts of key proponents of each –ism, insight into the –ology can be achieved.

In terms of the model, the boundary to the left is obvious enough, and Biblical Studies and Church History are frequently referenced to identify significant themes and pertinent authors. The text as information is assumed, but the object of study is one step removed from accessing the text, to evaluating the argument. By now, the concept of data at this level of research is virtually out of sight.

Summary: Primary sources for campus-based research are the rhetorical and analytical methods of thoughtful authors selected because of their known contribution to knowledge and understanding of truth and reality as addressed by a disciplinary standard theme. The desired contribution to knowledge outcomes correlates findings by making connections with life as lived in the present by increasing virtue.

Further Considerations

The current situation in which the student seeks information has been described in terms of abundance (Lewis, 2013). Global digitization projects are making pre-1923 public domain documents accessible at an unforeseen rate. Strong local collections supplemented by robust interlibrary loan practices provide timely access to the publishing heritage of 1923 down to the present. Online access to journal publications and a growing number of books has become the norm. Navigating this abundance to find the few sources beneficial for the assigned writing project has become a much more involved challenge. Beyond the skills required for using information technologies, an expanded emphasis on evaluating sources has become essential. This situation also motivates the discussion of the DIKW model in a couple of related conversations.

From Critical Thinking to Discernment

Coleman (2009, pp. 60-63) distinguishes between criticism and discernment. In criticism, the focus is on what is wrong, while discernment seeks what is right. While critical thinking seeks to eliminate the false, discernment attempts to sift the good out of the rest. Both dispositions avoid gullibility. Though it is pointless to draw a line between the two, I would suggest critical thinking dispositions predominate at the level of pre-reading information seeking, while discernment figures most significantly in the writing phase.

When dealing with the objective data and their first-hand documentation, critical thinking dispositions serve the secondary researcher effectively by discounting that which cannot be verified or validated (Fallis, 2004). Given the historic role of falsification in knowledge creation (Abel, 2011), a healthy skepticism towards information sources is expected. More is needed than the simple existence of a document in order to trust it unquestioningly as a reliable source. In reputable publication venues, it can be reasonably assumed that the author of the document is not intentionally deceptive (Williams, 2002, pp. 88-93), but human experience recognizes certain metaphysical limitations, reinforced in religious teachings, so as to invite caution on the part of the reader. So while it may be true that the author sincerely believes what she asserts, it can also be assumed that the information is fallible, limited in some way by time, location, perspective, or cognitive ability.

At some point, however, discernment needs to be engaged. While suspicion of an author's omniscience should never be abandoned, the quest for knowledge refocuses on finding the diamond in the dross. This is particularly pertinent for the knowledge-driven and wisdom-driven disciplines as sketched in the DIKW model. While testifier A may not have the complete answer, she contributes an invaluable insight. When connected with the insight of testifier B, in

light of experience C and circumstance D, new knowledge is created. A metaphor that helps illustrate this process is the Dot-to dot coloring books of young children, in which the drawing of an object emerges when lines are drawn from dot to dot in the correct sequence. The research task includes not simply finding a bunch of unrelated dots, but discerning which dots to connect. These are epistemological processes of justification and valuation.

This line of reasoning informs the pre-reading selection of sources suggesting a more intentional search strategy is needed than might have been required in less information-abundant times. Such a search strategy not only reflects a practical knowledge of search terms and databases, but also more thorough understanding of the discipline and of the history of the scholarly communication within its literatures. In the absence of strong prior knowledge, this may require a more thorough review of tertiary sources as a preliminary step in the research process.

Cross-disciplinary Thinking

One unintended possible outcome of using the model needs clarification. In the DIKW hierarchy, there is an intuitive progression from data to wisdom. When the question involves what a machine might be engineered to accomplish, the hierarchy does represent a lower to higher level of thinking. But this model is not a hierarchy. Its purpose is delimited to the identification and use of "primary" documents within recognized disciplines. To assume from the model that systematic theology as a wisdom-driven discipline is of a higher level or of greater value than a data driven research paradigm would be missing the point.

If anything, it is hoped that the model provides a talking space for cross-disciplinary conversations. The typical M.Div. curriculum provides students with a broad exposure to the disciplines as described in the model. It can be anticipated that all these research paradigms will

inform and enrich professional practice when students graduate and are working as professional clergy. However, typical attitudes concerning expertise have tended to aggregate knowledge into disciplinary silos (Adler, 1986). This silo effect can be seen in term paper assignments, theses, dissertations, and even the departmentalization of the school. This line of thought reflects Osmer (2012), who makes the following observation with regard to trends in contemporary theology:

> "The problem of integration across specialized disciplines is now viewed in both theology and theological education. The specialized disciplinary silos of the past are giving way to the importance of cross-disciplinary thinking: the ability to bring several fields into conversation with one another. This is important for pastors as well as theologians. In their leadership of congregations, pastors regularly face issues that are multidimensional and call for the perspectives of several fields and professions." (p. 330).

Thus it is suggested that an individual, whether student, professional practitioner, or academic faculty, has much to be gained by wandering all the fields, both methodologically and cognitively. From this perspective, situating a disciplinary method in a specific field is merely instrumental and relational, not ontological.

Conclusion

A model has been presented for identifying primary sources in the four classes of disciplines represented in Seminary education. The conceptual basis for the model drawn from information science is the conventional DIKW hierarchy, except that instead of a hierarchy, the terms are laid out as adjacent parallel fields with boundaries visible up close, but not clear from afar. The disciplines identify primary texts differently, based on the focus of the research which correlates with one of the DIKW categories. Critical thinking skills verify and validate information sources, serving well in the pre-reading phase of information seeking. Discernment seeks to justify and valuate the information collated from reliable sources as it is incorporated in transformational learning. The fields model also encourages cross disciplinary conversations.

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