KNOWLEDGE STUDY
BETTER QUESTIONS – BETTER ANSWERS

John L. Gordon 2017

AKRI Ltd

ABSTRACT

This paper considers a working methodology and tool which facilitates the study and analysis of human knowledge; specifically, the knowledge which people need to know in order to achieve things. Initially consideration is given to the important topic of asking the right question to guide the knowledge study. The study itself is intended to answer a question of the form, what would a person need to know if they could …

The knowledge study method is described as an investigation which produces a visual map of the knowledge components of a knowledge area, organised by learning dependency. Learning dependency is a useful structure for maps of human knowledge because it reflects the way people need to understand some things before they can learn new things.

The visual map is supplemented by well targeted but brief documentation. In addition, experts from the knowledge area are asked to comment on each piece of knowledge identified by providing opinion on a range of parameters which can collectively be referred to as knowledge risk.

Analysis of the study is mainly carried out automatically by the knowledge study tool. Interested parties can see and understand the human knowledge influence across an entire knowledge (or business) area. Risk assessment of this human knowledge is also available. The availability of results will depend on what study options were set at the outset. For instance, it might be that an organisation wishes to see how knowledge requirements change over the life of a project.

The final part of the paper looks again at how the guiding question is a key component of a knowledge study. It is also claimed that the question is even more important when the knowledge study method is used to explore concepts. In this case, the method can be used as a thinking and exploration tool by the user.

INTRODUCTION

It is the case in most scientific, technical and social studies that the question one asks is directly related to the quality of results one can achieve from an answer. This is also true of the study of human knowledge. Organisations have investment in knowing what they need to know. What they need to know is typically and overwhelmingly related to what the people who work for the organisation need to know. It might be unfashionable to claim that the things which people know are actually more important to an organisation than all of the documented processes and all of the intranet based help services which they might possess or strive to develop. After all, it is the people who are typically delivering business success for an organisation. Even well documented business processes are normally delivered by people and they must know how to access, assimilate, interpret and deliver these documented processes.

Organisations often invest, sometimes heavily, in documentation of their activities and neglect to pay enough attention to understanding what their staff need to know in order to deliver their service or manufacture their product. This paper is intended to focus attention on human knowledge.

Knowledge Structure Mapping has been a working method for knowledge study since it was first formulated in the 1990s. Since 2005, Knowledge Structure Mapping has benefitted from commercial knowledge study project feedback and specific business and organisational requirement feedback. It has become a proven methodology and software support system aimed at understanding what people need to know in order to deliver organisational services. Organisations such as Airbus, Rolls-Royce and Sellafield have contributed to the development of the commercial service by providing additional requirements based on knowledge study work. Before that, many other organisations, some business based and some socially based have contributed to the formulation of the foundations of knowledge study. This contribution can be traced back to the first valid knowledge study which took place at British Aerospace in 2000 and addressed the topic of Super Plastic Forming and Diffusion Bonding. But the apparent complexity of the initial topic can be misleading because it is possible to study any human knowledge requirement and basic hotel operations and even shop services have also featured in the development of Knowledge Structure Mapping.

The method of Knowledge Structure Mapping is, it is claimed here, a very successful methodology to both study and gain benefit from human knowledge. Yet even this claim cannot be properly justified if the study does not follow an appropriate question. Asking the best question which will guide a knowledge study is an essential component of the method.

This paper is aimed at presenting the method in outline, showing how the right question guides a study and discussing the business benefit which can be delivered.

The paper will initially consider the question; what form it should take and how to try to make sure the question will deliver desirable results. The second part of the paper will consider the method of knowledge study and what sort of information is collected during a study. The third part will be focused on the analysis of the information collected and how to structure this to provide business benefit. Since the method has been evolving for many years based on feedback and requirements from commercial knowledge studies, it will only be possible to consider method and analysis in brief. The final part of the paper will discuss the role and potential of this type of knowledge study in both commercial and non-commercial environments.

THE QUESTION:

The question concerns the knowledge which people need in order to deliver a specific service or carry out a specific task. Whilst the task needs to be well bounded, it needn't be small. Questions will typically take the form:

What would a person need to know in order to carry out task x?

This question is not very useful because it is not focused and it does not consider scale or expertise etc. It might be that the question should investigate expert knowledge or simply the knowledge required for practical capability. It might also be that the knowledge is typically held and delivered by many people collectively and no one person holds all of the knowledge. These and other conditions should be addressed by the question and agreed by all participants in a knowledge study.

THE QUESTION OF SCALE:

The question of scale needs to be addressed if more than one person holds the knowledge to deliver the service in question. This is typically covered by asking the participants to consider one 'super human expert' who knows everything within the knowledge domain being studied. What would that expert need to know? This has always worked well in practice because it simplifies the study of scale and helps to focus the study on knowledge, where it should be focused. This is also the most common type of knowledge study conducted.

THE QUESTION OF EXPERTISE:

Typically, a study considers knowledge at an expert level. This means the study considers many aspects of the knowledge area yet can also show how capability rather than expertise can exist. Of course, it is necessary to have a working definition of capability and expertise in this context and the knowledge study tool provides this. It is possible to assign actual people to the knowledge once elicited and these people can also be categorised as either expert or capable in a knowledge component of the knowledge area.

THE QUESTION OF FOCUS:

Making sure the question is properly targeted at the knowledge domain which needs to be studied, to the exclusion of other knowledge, is important. Linkages within human knowledge can grow exponentially if not constrained. Whilst such exponential growth and how it develops might be considered interesting, it is not constructive within a business context.

Making sure the question is focused, also offers another advantage. It forces those commissioning a study to consider what the results might be like and then what they might use them for when they are delivered. Not using results of a knowledge management project is not uncommon within the business sector.

The focus might take the form of defining the knowledge to be studied briefly but carefully within the question so other related knowledge is excluded by the question. It might be useful to specifically exclude some related knowledge within the question. A question addressing what an expert sales person needs to know might specifically exclude the administrative duties which the sales person would probably be required to carry out. This might be done because the organisation wished to focus on sales method and technique.

QUESTIONS:

It might be interesting to consider two questions which could be seen as extreme examples of knowledge complexity.

- What does an effective and talented President of the United States of America need to know in order to ensure that the USA improves greatly in the service of its citizens and functions very well as a world power for peace and stability?
- What does a person need to know in order to change the front wheel of a typical bicycle so that the bicycle can function effectively and safely after the change?

Whilst these questions address totally different things, they can be studied in exactly the same way using the knowledge structure mapping method. Analysis and result delivery would look very different but would each be carried out in the same way using the same tools.

A question could also address a knowledge area which is typically not fully known by any individual.

- What knowledge would a person need in order to know how to decommission an end of working life Nuclear Power Plant safely and cost effectively and return the land occupied by the plant to safe public use?

In this case, the question is looking for an expert who knows how to do a complex multi component task rather than for a person who will actually do it. This is an interesting distinction and an important one to consider.

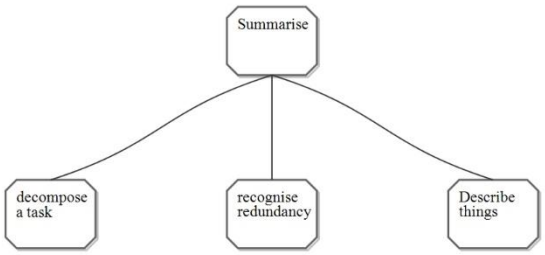
A study question is set before a study begins and can typically lead to considerable debate amongst a management team commissioning the work. In this case, as in other knowledge management work, the knowledge study specialist must be able to help and offer guidance to make sure the question derived will lead to a successful outcome. A little thought here about the meeting where the management team derives such a question can reveal how consideration to the sort of results which can be expected and what an organisation might do when they are delivered, is probably inevitable.

KNOWLEDGE STUDY:

Rather than discuss a working methodology or procedure, this section will instead focus on what a knowledge study looks like and how it is structured. Delivery of the method does require some learning and some practice if it is to be done well but the basic idea can be explained much more easily.

A KNOWLEDGE STRUCTURE MAP:

A knowledge structure map is intended to be a diagram which shows human knowledge as elements or blocks which together make up a knowledge area. The knowledge elements or blocks are organised in a way which is intended to represent the way humans learn their knowledge. Items of knowledge are dependent on a prior understanding of other items of knowledge. This learning or knowledge dependency is only valid for human knowledge and the method in general is aimed directly at human knowledge. Of course, it is possible to raise some objections to the structure, for instance that any dependency structure might not represent the only way to learn something. Yet, if constructed well, the map does represent the knowledge area and the dependency structure within it is valid for people and can easily be read and understood by people.



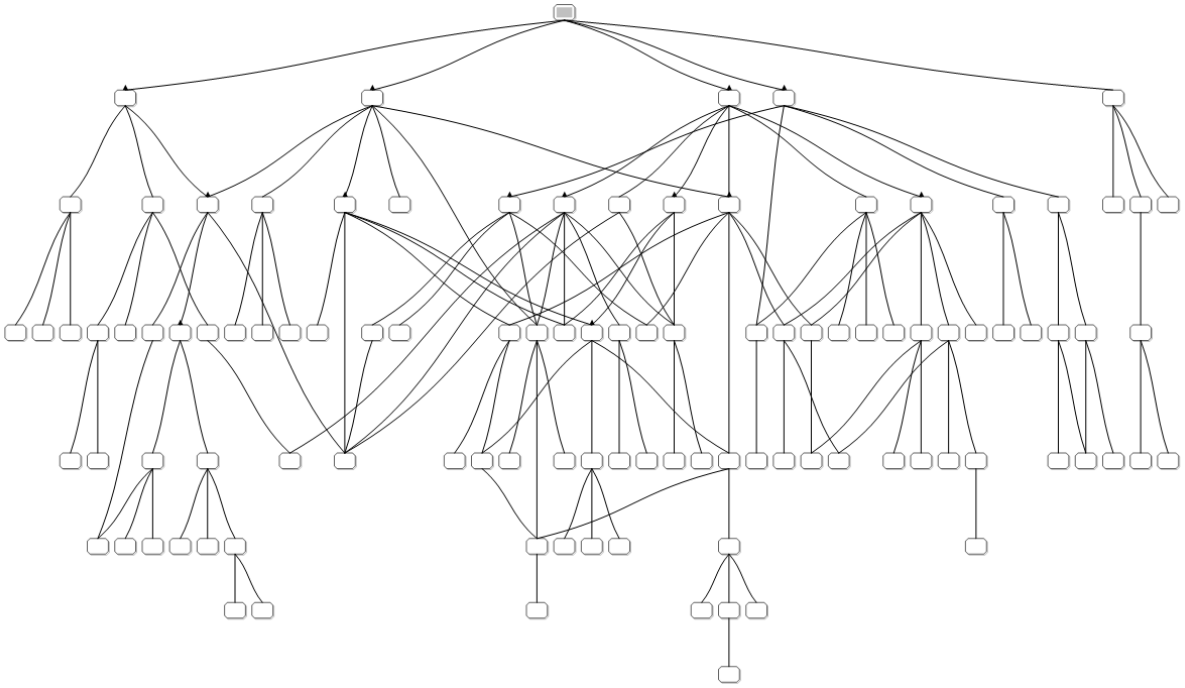
You might not agree with this map but it considers the following knowledge:

- Know how to capture the main points of something and present it briefly.

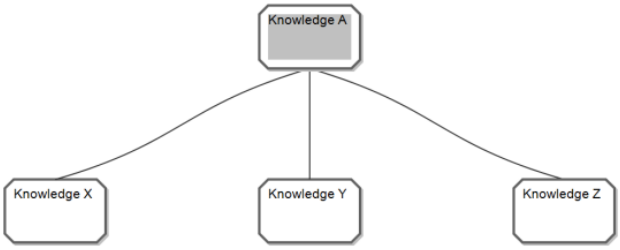
If one knows this, then it can be assumed that the person who knows this also knows the following:

- How to break a complex task down into more manageable components that when reassembled address the initial complex task
- How to notice when similar things take on essentially the same meaning or make the same point
- How to create a mental image in others that represents the object, situation or concept being studied

The same approach to developing the top item of knowledge can then be applied to the other items uncovered by considering the first. After some investigation, a knowledge structure map might take the following form:



This map shows a knowledge area as understood by people (or person) where its structure is based on learning dependency as outlined above.



Stated in simple terms:

If a person fully understands (knows) knowledge A then it can be assumed that the person must also know Knowledge X, Knowledge Y, and Knowledge Z.

Because: without an understanding of X, Y and Z the person could not have learned and understood A.

ELICITING INFORMATION FROM EXPERTS:

Maps are generally derived by interviewing experts from the knowledge area. However, it is possible, with practice to create maps using one's own knowledge or knowledge acquired from other sources. This paper will not discuss the interview technique even though this is important, instead it will focus on what information is and can be derived during interviews.

Clearly, it is the experts who provide the information which is used to construct and structure the map. Experts typically require help with this process but they are nevertheless the holders of the knowledge and can almost always comment on learning prerequisites (if helped to do so). The boxes or knowledge element on the map are identified with Knowledge Names. These are brief names which identify an element of knowledge such as 'decompose a task'. Such names are very useful but in themselves are not enough to properly identify knowledge and remove ambiguity. Each knowledge node should therefore also contain a definition (of the knowledge) and a brief summary (what it means or how to do it). Definitions and summaries are typically one or two sentences long.

There are facilities for additional text to qualify a knowledge item but these are optional. In addition to this documentation, experts are asked for their opinion about each knowledge item identified. This opinion is expressed as a number between 0 and 10 with clear descriptions identifying what each number means. The numeric data is part of a knowledge risk assessment which is carried out during analysis and not during interviews.

When a (knowledge study) project begins, a set of parameters which require expert opinion are agreed upon. This set of parameters is used to define knowledge risk for a specific study in a specific industry. Normally between 4 and 8 parameters are selected from an available set of more than 30. Each parameter contains a question which is asked of the experts and allows the expert to select a value which also contains a description. For instance:

How important is this knowledge to the knowledge area being studied?

0. not important at all
1. hardly important
2. very slightly important
3. slightly important
4. a little important
5. fairly important
6. quite important
7. rather important
8. very important
9. quite critical
10. absolutely critical

Other parameters consider things such as staff availability, learn time, specialisation etc. The set of parameters used in a study defines the way that the organisation wishes to consider human knowledge risk.

There are options to add additional information to a study. For instance, it might be that the organisation wishes to consider the human knowledge requirements over a long period. To address this, it is possible to identify at what points in the project various knowledge elements are required. This provides a temporal context to the knowledge study.

Many more options exist but the main ones to consider for the context of this paper are the text based and numeric based parameters discussed.

CONTROLLING THE QUALITY:

Quality control is part of the methodology and the details are not important here. However, the reasons for quality control will be identified.

When people talk about their own knowledge there is at least the chance that bias might alter numeric parameter values. It is perhaps easy to see how a particular expert might identify their own knowledge as being more important to a knowledge area than knowledge which they don't possess.

Parameter value bias can be controlled to some extent during interviews and the tool which supports the method provides ways of helping the expert to see the assignment of their

parameter value within the context of the entire study. This moderating function is best carried out by a single person with unbiased interest in the entire study and with an interest in the results. Using a single moderator periodically throughout the study information collection phase also helps to free the experts from this role and allow knowledge exploration to make better progress.

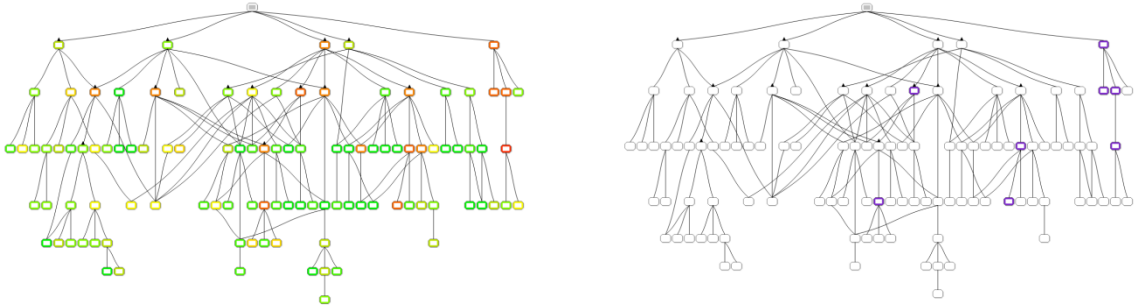
Quality issues can affect the map structure. It is not uncommon for experts to claim that many things really need to be known in order to fully understand a specific item of knowledge which is important to them. It is not uncommon for experts to claim that the entire knowledge area requires some advanced maybe technical knowledge in order to justify a full understanding of it. Many of these quality issues can be corrected during interviews which involve several experts but the moderator can also provide this quality control information. It is however necessary that the person conducting the study is aware of these issues and alert to them.

Analysis of a Knowledge Study:

A full analysis of a knowledge study will depend on the way the study is set up at the outset. However, there are several features which are common to almost all studies and these will be the main ones identified in this paper. A software tool has developed alongside the method and its capabilities have been influenced by interested parties in many organisations, usually following the delivery of a study report or subsequently when the organisation asks if the study could also address an item of specific interest to them. The knowledge study tool can now carry out most of the analytical work at the end of a study but this does not remove the need for review by a skilled knowledge study expert.

Parameter value assessment:

At the end of a study, each item of knowledge contained on the map will have a valid parameter value for each parameter in use for that study. It can be informative to consider the entire map with respect to each parameter. This information can be viewed as a data table but it can be more informative to view it as either a colour coded map or a map which shows where trigger points for risk have been reached for that parameter.



The figure on the left above, shows the map colour coded for 'recovery'. If the organisation lost this knowledge, how difficult would it be to recover it? The colours used are Red – Amber – Green in this case but these can be changed. If you know which areas of knowledge are which (and you would do) then this view gives a good impression of the knowledge areas which contain knowledge which it might be difficult for the organisation to recover. The map on the right shows which knowledge elements have reached a high risk trigger point for that parameter. In this case the trigger point was set at 8, very difficult to replace. So, knowledge which is very difficult to replace and worse is identified on the map and humans can often see patterns when they inspect such data.

Interesting information about the knowledge area can be revealed by combining parameters like this so that the map is, for example, colour coded to show knowledge which is both very important and very difficult to recover.

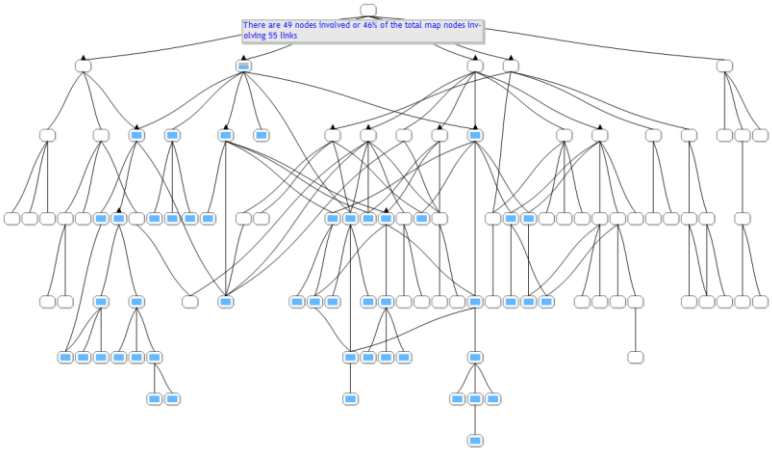
If all parameter values are combined as a weighted average then the resulting view whether it is a table or a map visualisation, is referred to as knowledge risk. Here an organisation might have defined knowledge risk to be knowledge which is:

Very important, very difficult to recover, mainly learned through experience and known only by very few people.

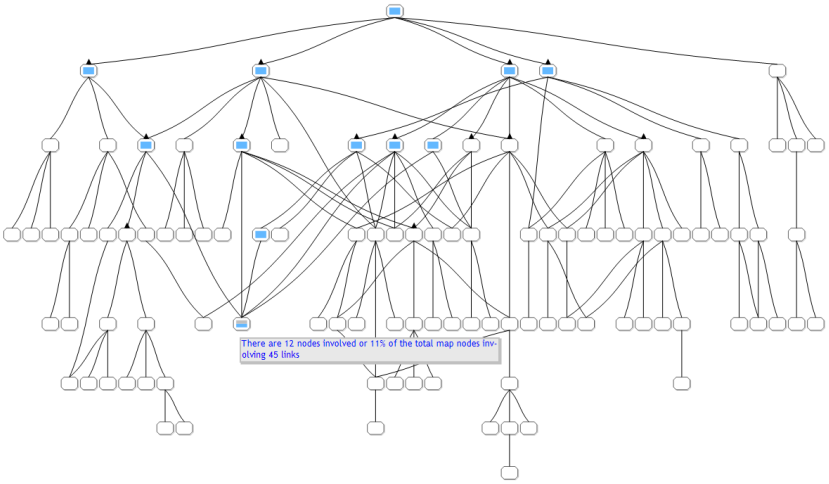
Of course, this statement of knowledge risk depends on which parameters are in use in a study and how many (*maximum 8*) are used. There are additional ways of viewing knowledge risk within the context of this map. This reflects the key role of knowledge risk in the analytical process.

Map Structure Assessment:

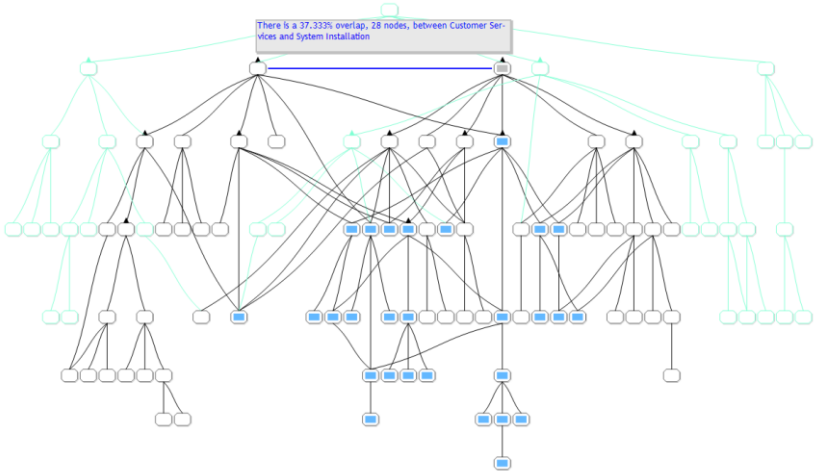
Structure analysis is underwritten by learning dependency. If a person knows A then they must also know X, Y and Z. Therefore, if a knowledge area is selected, the knowledge which is prerequisite of this would be known by an expert who fully understood the selected knowledge. The figure below shows the knowledge structure which an expert in 'System Installation' would know in this case.



The map below is showing which knowledge is dependent on the knowledge selected at the bottom of the map, in this case, 'Communicate with customers'.



One last view of the analysis of map structure shows the knowledge which is common to two knowledge areas. In this case the map is visually demonstrating a 37% overlap between the knowledge requirements of 'Customer Services' and 'System Installation'. It is left to the reader to consider why an organisation might find this information useful.



As with numeric analysis, there are additional structure analytical features available.

Additional Analytical Options:

Over many years, the knowledge study tool has grown to provide very many analytical options and it will only be possible to provide a flavour for them here. Rather than attempt to provide too much unnecessary explanation I will simply list some of the additional analytical features available.

- People assignment and Expert analysis
- Knowledge gap analysis
- Knowledge area improvement analysis
- Temporal knowledge needs analysis (across a long project)
- Learn time analysis (how long will it take to educate new experts?)
- Parameter profile analysis
- Whole map or study visualisation
- Etc.

In addition, the tool is able to export a fully indexed web resource which contains all of the data added during the study, all of the automated analysis and any study conclusions, recommendations and options for action which have been derived. The tool can also export all entered and derived data as CSV files which can then be used in project information resources by the organisation.

Whilst this brief view of analysis has concentrated on the map visualisation, it is possible to view all of this data as tables and charts. It is also possible for instance, to step through temporal map views to show how knowledge requirements change over the lifetime of a project.

THE POTENTIAL OF KNOWLEDGE STUDY:

Since questions are an important part of this paper it might be useful to ask some questions relating to the role and value of knowledge study in both commercial and non-commercial environments. The assumption made is that we are discussing the study of human knowledge, the knowledge people need to know in order to do things. So, knowledge study refers to the study of what people need to know and it assumes a visual representation (map) organised by learning dependency, the way people acquire the knowledge they need.

Questions for a commercial environment:

- How can knowing what employees need to know in order to do their work be of any benefit to an organisation?
- Could knowledge study help an organisation to solve difficult problems and if so, how could it do this?
- Is it more important to document all procedures and processes than to try to manage human knowledge?

Questions in a non-commercial environment:

- Is there any justifiable reason to study human knowledge in the way proposed?
- What if two separate knowledge studies of the same knowledge area produce different map structures and are they likely to?
- Could there be any benefit in holding these representations of human knowledge for future reference?

Clearly these questions are just a sample of those which might be asked of knowledge study. Yet answering these questions will help those people concerned to understand the topic and to decide whether this topic is of interest to them. Answering questions however is not always easy. Yet it is usually easier than asking good questions at the outset. Answering bad questions is still difficult but typically of no use, or worse, it can be destructive.

These questions might make a good starting point in deciding what each reader thinks the potential of knowledge study is. There are certain to be varied and conflicting opinions but it is also true that it will be more valuable for you to form your own opinion. The questions might help.

KNOWLEDGE STUDY TO AID THINKING:

For my part, I have seen the results of many knowledge studies and have been able to form an opinion from first hand data. But to be honest, whilst I really believe knowledge study is of considerable benefit to organisations, I also find it very useful as a thinking tool.

On many occasions when I want to think about a concept I create a knowledge structure map of….

Of what, of the knowledge needed to understand the concept maybe, or the knowledge needed to deliver the concept or the knowledge needed to evaluate the concept. What question should I ask if I want to study human knowledge related to a concept?

To make the point I will refer to three of the concepts I have studied (a little) in order to think about them and understand them better myself. When I say studied, I have not used experts, I have researched the information as I uncover knowledge requirements on the map. Using experts would have been nice but they are not accessible to me.

The three concepts I will highlight here are Rights, Negotiation and Justice. In each of these cases, different questions would have led to different study results. I will present the questions I used and you will be able to think of alternatives quite easily.

- The knowledge needed to fully understand the concept of personal rights in a civilised society including the assignment, delivery and implications of rights. This does not include knowing specific rights but will include knowing how to decide whether it is justifiable to assign a right and which groups it should be assigned to.
- The knowledge required in order to know how to conduct a successful negotiation between self (representing self or an organisation) and another party.
- What knowledge is required in order to be able to provide useful, accurate and contextual advice about any system of justice whether historic, operational or proposed?

In knowledge study, the question asked guides the study as it unfolds. I hope it is clear from these three examples that the question is likely to be important. Of course, the knowledge study specialist must stick to the question when investigating the knowledge area. If that is not done, any map produced will be less than useless. Less than useless because it might be taken as valid and lead people to making bad decisions based on invalid knowledge study results.

QUESTIONS:

I think I can claim that the method of knowledge study discussed in this paper is valid and useful. Whilst I do not wish to detract from this observation, I believe strongly that questions are one of the most important and fundamental components of good progress. I hope I have shown that knowledge study can help to control thinking and provide objectivity to thinking and just one of the ways it can do this is by demanding a good question to investigate.

Good questions are critical for success.

I believe Einstein said “Any fool can know. The point is to understand.”.

Maybe he *might* also have said! “Any fool can come up with answers, the point is to answer the right question.”.

REFERENCES:

Reference material in the form of papers can be found at: http://akri.org/research/papers.html

Introductory information can be found at: http://akri.co.uk/

Further reference can be found at: http://akri.co.uk/index-old.html