Architecture of 3-D knowledges for e-learning

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Abstract

In this white paper we present a model of personal knowledge which is based on the number of dots the person can see, and thus the dimensions of knowledge. E.g. one dot indicates dimensionless knowledge, two dots indicate one-dimensional knowledge, then the three dots for two-dimensional knowledge, and the highest knowledge level is the three-dimensional knowledge indicated by four dots. Based on qualitative examination of this model we determine which part of deliverable knowledge is appropriate for e-learning at the different knowledge levels of the teacher.

Keywords: architecture of knowledge, knowledge levels, curriculum development, e-learning, leadership

Introduction

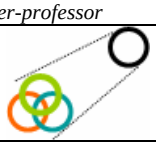
Our new conception of knowledge describes the knowledge levels using to the number of dots the person sees and the relationship of between these dots. This model provides a comprehensive explanation of the qualitative differences between the knowledge levels. We have adopted an unusual starting point to this research, namely the ancient wisdom of Hermes Trismegistos. This is not a scientific starting point indeed but this is in complete coherence with our anti-methodological approach adopted from Feyerabend (1993): "Anything goes." There was an additional starting point, namely Marcuse's (1964) "One-dimensional man". Apart from speculation and discussion we also used ex-post unstructured phenomenological observations from our extensive experience in teaching and consulting, as well as thought experiments. Hermes Trismegistos explained the world using numbers 1-9, 1-4 indicate what is in our world, 6-9 describe the transcendental world and 5 mirrors the one to another. Here we use 1-4 to describe the levels of knowledge.

A new conception of transferable knowledge

Although it was not our original intention, during the examination of the model we have discovered that our new model is also consistent with the previous models of knowledge levels. Dreyfus and Dreyfus (2000, pp. 19-36) gave a qualitative description of knowledge levels. Mérő (1990, pp. 119-121) added a qualitative description by positioning the knowledge levels according to the number of cognitive schemata. The first description does not provide much in terms of indicators according to which the knower can be classified and the second is perfectly accurate but it requires a lot of effort to estimate the number of someone's cognitive schemata in a certain discipline. Our new model is qualitative and it also provides tangible and easy-to-use indicators to classify the knower as well as easy understanding of the qualitative differences. Our model appears to be completely consistent with the mentioned two models, although there is no conclusive evidence yet about this.

In our model, the knowledge levels are described by the number of dots which the knower can 'see'. In reality there is a smoother transition between the levels; here only the pure types are introduced. (See Table 1)

Table 1: Teaching-learning according to the knowledge of the educator.

	0-D knowledge *presenter*	1-D knowledge *instructor*	2-D knowledge *lecturer*	3-D knowledge *master-professor*
model of knowledge[1]				
elements of knowledge[2]	doctrines	two keywords connected by a causal relation and a method	three keywords and four[3] (3+1) intersections	three keywords, four intersections and a meta-concept
amount of[4] knowledge	12x1=12 elements	(12x2)+(12x(1+1))=48 elements	(6x3)+(6x(3+1))=42 elements	(4x3)+(4x1)+(4x4)=32 elements
knowledge transfer	E-learning 0%	E-learning 50%	E-learning 43%	E-learning 37%
knowledge of the learner[5]	list of doctrines	list of isolated relations and methods	set of concepts	meta-knowledge (essence)
applied knowledge	repeating the doctrines (facts)	accomplishing tasks	managing processes	creating solutions (seeing what nobody has seen)
knowledge media and authors	several authors HANDBOOK		single author TEXTBOOK	team of authors led by a master BOOK

The knower at the lowest knowledge level may see isolated dots only, which correspond to isolated facts or doctrines presented as facts. This we call the *dimensionless (0-D) knowledge*. At the second level the knower sees two dots at the same time and can connect them by a directed relation, such as causal relations or logical 'if… then' rules. Along these relations methods can be devised, i.e. we can learn how to get from one point to another. As two dots determine a line this we call the *one-dimensional (1-D) knowledge*. It can be expected that the next level should be called *two-dimensional (2-D) knowledge* and be described by three dots. If one sees three dots the simple relations from the previous level will prove poor for providing satisfactory explanation. Thus we describe this knowledge level with three sets in intersection. This does not mean, of course, that on this level the knower cannot handle e.g. causal relations (any two from the three dots may be connected by an arrow); this means that here we can have a richer picture of less rigid relations, such as intersections. The highest level of knowledge presented here is the *three-dimensional (3-D) knowledge* corresponding to four dots. We know little so far about the 3-D knowledge but there are several details observed. The fourth point is qualitatively different from the previous three; it somehow throws light to the previous three through their interrelations (this is why there are fewer elements at this level than at the previous one). There is no much sense to try to describe higher knowledge levels – very few of us can imagine pictures of more than three dimensions.

In the present paper only the knowledge of the educator is used as a point of reference but in application we also must take into the account that the learner can only perceive teaching delivered one level higher than her/his existing knowledge (meaning that the delivered teaching cannot be higher than that; it can always be lower – but why would we do that?)

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[1] A particular topic is described by keywords and their relationships.

[2] Another proof for the capacity limit of STM – there can be no more elements than 7±2. (Miller, 1956)

[3] The four intersections in two-dimensional thinking do not mean the same as in the three-dimensional thinking. In two-dimensional thinking the 'fourth' intersection is only a special case; thus it is said to be '3+1'. At the same time in the three-dimensional thinking it is something new, often the representation of or a shortcut to the essence.

[4] Assuming 12 weeks in a semester.

[5] The new knowledge that a talented student may achieve.

We shall now examine somewhat more closely how much of knowledge at different levels can be transmitted in one semester. The explanation is summarized in row 2, 3 and 6 of Table 1. For this we assume 12 weeks in a semester and that the teacher can transfer in one block[6] only what can form a single whole in her/his mind.

The presenter with 0-D knowledge can do nothing but citing doctrines, which (s)he will present as facts. For example, a presenter may provide her/his students with list of leadership roles – with no connection between them. One lecture can cover one doctrine, as in 0-D knowledge there are no connections between the knowledge elements and thus more than one element would not fit into a single whole. So, at 0-D level, 12 doctrines can be delivered in a semester – and the learners will end up reiterating these doctrines. If they learn something more it is due to their talent or previous knowledge. The high performance at this level can be described as *precise*.

1-D knowledge provides delivery of two keywords with a relation between them and a method based on this relation. These four pieces can form a single whole in the mind of the instructor, so (s)he can deliver 4 pieces each week, which makes 48 pieces within a semester. Examples for this kind of knowledge delivery may include the instant ways of improving motivation. The learners of such courses will be able to accomplish well-defined tasks according to the learned recipes – and will wonder why the instant solutions very often do not work. The high performance can be described as *efficient*.

In the 2-D knowledge of the lecturer a unit could consist of three keywords and four intersections representing the relations, which are more complex than those on the previous level. However, if the new knowledge would be delivered at the pace of 7 elements each class, one can hardly believe that the students could keep up.[7] Therefore, the 12 weeks are here divided; delivering 3 keywords on 6 occasions and 3+1 intersections on other 6 occasions. Therefore, the students will receive a smaller amount of knowledge (42 pieces) than on the previous level but it will be of higher complexity. Such teaching means e.g. explaining the role of values and knowledge in teamwork.[8] The student, who learns all that is delivered, will be able to manage some processes, in the present example teamwork processes regarding knowledge and value systems. There will be a limit to this managing and the student will be able to recognize these limits but will have no chance to do something beyond the limits. The high performance can be described as *effective*.

The master-professor's 3-D knowledge consists of four dots, three of which are the keywords and the fourth we call the meta-concept. However, the relations that are presented here are not between the four dots directly but between the meta-concept and the intersections of the keywords. We could say that through the intersections the meta-concept illuminates the keywords. These pieces can form a single whole in the mind of the master-professor – for her/him it is all contained in the meta-concept. This level of knowledge delivery is barely structured and thus it is difficult to grasp. We can only observe that the master-professor often uses parables (sometimes from a totally different domain) to illuminate what (s)he wants to say; i.e. the meta-concept often takes the form of a parable. This knowledge is of extremely high den-

[6] Regardless if a block means 2 or 2×2 hours of teaching time.

[7] Our previous research suggests that, regardless to the length of the class, max. 3-4 pieces of new knowledge can be delivered to the learners.

[8] These keywords will also appear in a forthcoming example but each of them will belong to a different topic. By putting them in a different order we want to illustrate that there is no single right way.

sity, so we divided the 12 weeks into 3 chunks this time. On 4 occasions there will be 3-3 keywords delivered; on other 4 occasions a meta-concept will be introduced on each; finally on 4 occasions the relationships between the meta-concept and the 4 intersections are described. This means altogether 32 pieces of knowledge in a semester. An example can be if the master-professor explains the example from the previous paragraph using a story of Herodotus, of the top executive (s)he had a lunch with, or of the yesterday's reality show. The talented students will have a better understanding of knowledge, value systems, and teamwork – not necessarily being able to put into words how they understand them. The high performance *cannot be described*. But ask them for help if the students from the previous paragraph got stuck managing their processes – these guys may have some ideas.

From the model in the previous section, it is easy to see implications about the usefulness of e-learning at the different levels. E-learning is appropriate media to deliver keywords: it is superfluous for the knowledge elements of lower complexity and inappropriate for those of higher complexity. Thus the 0-D presenter cannot make use of e-learning. The best use if e-learning is made at the 1-D knowledge level of the instructor (24 keywords = 50% of all), i.e. by replacing handbooks in education of task accomplishers. Somewhat less at the 2-D knowledge level of the lecturer (18 keywords = 43% of all), i.e. replacing the textbook for those, who will manage the processes. The e-learning is of even less use at the 3-D knowledge level of the master-professor (12 keywords = 37%), although this time it is not replacing the book – it is something else. To the students, who want to engage with problem solving, we suggest doing both: reading the book and using the e-learning.

Conclusions

This result was achieved using an unusual starting point and, for a long part of the research process, the work was purely speculative. However, once we have achieved the result, we have compared it to our teaching and consulting experience of several decades, using unstructured phenomenological observations and thought experiments. We have also found that our model is coherent with other models about knowledge levels. Its significance is that it provides comprehensive explanations of the qualitative characteristics of the knowledge levels and it can also serve as basis for developing indicators to help classifying knowers; as well as it is a good starting point for structuring a curriculum and deciding what to put into e-learning.

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