Ontological stratification of virtual learning activities - Developing a new categorization scheme

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Abstract:

Throughout the last 100 years instructional theory has developed many different educational models and learning scenarios. What schools are still missing is not only an educationally sound and complete categorization scheme, but also the application of these models to the new forms and types of virtual learning environments. Traditionally these educational scenarios lack detailed and finely granulated descriptions.

Such a description is only possible if it is guided by an underlying theoretical model of (e)learning and if the relationship between the higher level (educational scenario) and lower level (interaction pattern) are explored in detail. This paper suggests a new view based on the epistemological point of view - the so-called "theory of ontological stratification" - by Michael Polany.

1 The need for an educational categorization scheme on e-learning

During the last few years we have evaluated several different types of tools for e-learning like Learning Management Systems (LMS) and Content Management Systems (CMS) [1,2,3,4,5,6]. They are based on a special evaluation methodology by Michael Scriven, [7,8,9] adapted and further elaborated for the purpose at hand [10,11]. Based on an intensive market research, accompanied with qualitative description of the tools best ranked and updated on special websites [12,13 but see also 14] the results of our studies are well known in German speaking countries and serve as a kind of reference in the discussion of quality of e-learning.

But nonetheless: From the pedagogical point of view these evaluations show some limitations:

- The focus of attention is the tool and not the pedagogical situation: Our evaluation was a special type of evaluation – a product evaluation. Based on a market research they compare the different products in their functionality. So the unit of evaluation is the tool and not the pedagogical need and educational setting.
- They are based on the current market situation: As our starting point is the current market situation our results are time specific because of their market dependence. As

new players (products) enter the market or a new improved version is launched, we have to update our evaluation.

- They do not necessarily support a pedagogical driven point of view: Many times we are confronted with the questions: What is the best tool for e-learning? There is no answer to this very general – and as we believe: wrong – question: It depends on your needs, your favorite teaching model, size, time and pre-requisite of the learning group, technical and organizational environments, skills, etc.

The last item – to ask for the best e-learning tool without qualifying to what respect it should be the best – demonstrates a wrong conceptual model of e-learning: Give me the right tool and I will be able to teach effectively and with high quality. This assumes the tools itself as the basis, the solid groundwork on which to design the learning situations.

But the tools themselves are implementation of pedagogical theories. This is even true whether the developers are conscious of this fact or not, as we already claimed long ago [15]. Software for design, implementations, use and evaluations of multiple-choice tests clearly has another pedagogical model in mind as software, which is designed to support knowledge acquisition in groups and collaborative work.

So it seems that we should reverse this kind of thinking process: Instead of asking for the appropriate tool we should force the questions: "What kind of educational strategy is necessary to convey my pedagogical objectives?" and then as the second derived question to ask: "Which tool fits best within this educational scenario?"

If this line of thinking is elaborated and generalized it results in different educational scenarios as a starting point and ends with a specific tool (or subset of tools) from a set of available database of tools derived from the current market situation. In this case the tools are evaluated with respects of the different educational scenarios resulting in different "best" tools for different scenarios. To support this line of reasoning one needs in addition to the evaluated e-learning tools a sound categorization scheme as the starting point.

There is another reason for the need of a categorization scheme for educational scenarios. This time it is not derived from methodological aspects but from practical and experiential motives. We know from our work with teachers and from e-learning projects [16] that there is severe knowledge barrier to overcome. The majority of teachers working in schools are educated with traditional pedagogical models. They do not know at first hand about differences and/or common features of face-to-face and e-learning scenarios.

What they need is a kind of anchor where they can start from their actual experiences and some help to elaborate and develop their knowledge under e-learning circumstances. In this respect the question which is to answer is: Given a well known educational scenario, for instance "brainstorming": How can one use this technique in an online situation? What is the same? What is different? What kind of tool to use? etc.

So what we are looking for are kinds of well-known educational interaction patterns, that are described in terms of e-learning notions. These patterns are derived from general educational scenarios and should teach people the essence and skills how to use these pedagogical models under the new circumstances.

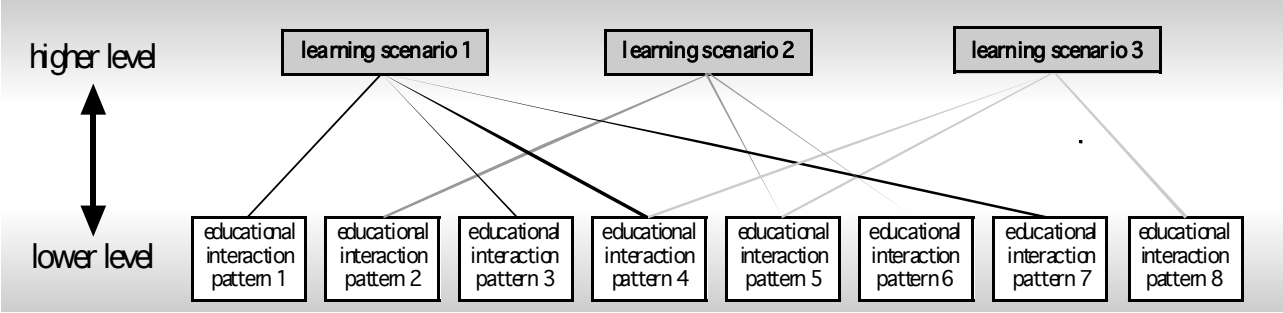

Fig.1: Higher and lower levels

2 Methodological considerations

Before we will go into substantial details it pays the effort to analyze and investigate the relationship between different levels of the categorization scheme.

2.1 Three levels of abstraction

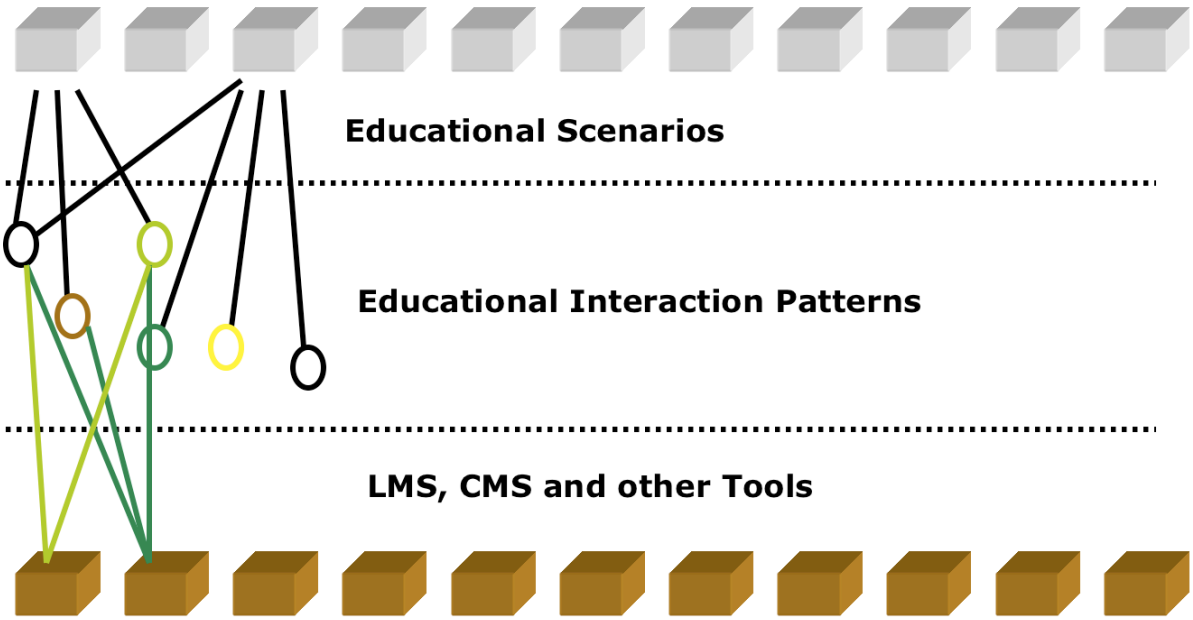

Fig.2: Three levels of abstraction

We will have three different levels: The first one (top level) is the most general one: It categorizes and describes educational scenarios, like guided discussion, brainstorming, disputation, open space and so on. The descriptions of these pedagogical learning models are completely independent of their actual implementation and this level will serve as the required anchor from where to start. Implementation details like differences between face-to-face or online learning or what kind of software to use are not relevant on this level.

The second level is in a certain sense the most interesting one: Here we need a detailed description of the different activities, which as a whole defines the scenario. Here you will find the differences between a traditional and an online learning situation. But still this description lacks technical details of the implementation. Questions like “What software product to use?” and “How to use a specific tool to implement a specific pattern?” are not

answered yet. This level works with general types of tools (like Software for Chats, Fora, email etc.) and not with specific products, their interface and functions.

It is the third level where the detailed description of specific products will follow. But in contrast to a more general evaluation of the functionality of the product the different function will be mapped to and evaluated in accordance to the educational interaction patterns. It describes the products in terms of the adequacy to a certain educational interaction pattern, which itself is derived from a pedagogic learning model. This has intriguing consequences: Some products are good for some educational patterns but not for others. In order to implement a certain educational scenario it could be that one needs not only different kinds of tools, but also from these just one or two functions.

2.2 Practical consequences of this categorization scheme

One of the apparent consequences of this proposed line of reasoning is that there is evidently no unique power tool suitable for all purposes. We know that this outcome may result in insecurities and even fear in the part of teachers as it means to get involved in the learning process of several different tools. There is also the additional costs and organizational overhead of different tools to consider.

But nonetheless we think that our approach is not only adequate for theoretical reasons but also for practical purposes:

- There is always to find a compromise between different tools and their functionalities, their product, implementation and support costs. It isn't feasible to buy and learn for every instance of different use the most adequate tool on the market.
- But it is important to know which tools support a specific pedagogical objective in a better way. And it is also important to know of the weaknesses of a tool. It is far better to know about the limitation of a product rather than using it in an inadequate way.
- This is the only way to learn to think of technological resources in educational terms. This is the only guarantee that educationally motivated users form a pressure group to force companies to improve their products in pedagogical aspects.

2.3 Epistemological consequences of this categorization scheme

This layered approach has also some epistemological consequences. To explore this kind of impacts we will follow a view based on the so-called "theory of ontological stratification" - by Michael Polanyi [17, 18, 19, see also: 20] The idea behind this theory is that there are always two different levels – a higher one and a lower one –, which constitutes a specific relationship to each other.

The higher level is the more general one. It constitutes the semantic aspect of the reality aspect in question. It is this aspect of meaning from which the lower level is considered. This functions like the focus of a flashlight in a dark night: It carves out some aspects (details) of the reality and presents them as the reality itself. The higher level is a kind of regulatory device, which structures reality. In a certain sense – as Constructivists will point out – it creates reality. "Reality" in this case is understood as a technical term of the interaction between higher and lower level, it is not intended to substitute the term "external world", e.g. the world outside of our minds. Reality (in contrast to the term "external world") constitutes an observer dependent relationship. This is what Polanyi calls "Personal Knowledge" in

contradiction to ideas of Sir Karl Popper who claimed in "Objective Knowledge" [21] that "true" knowledge is not an interactive category but independent from human beings.

The lower level on the other hand presents the phenomenological aspects of reality, the way the external world is presented to us, the way we as human beings perceive the external world.

It is now important to understand the complex relationships between these two levels: the higher level gives meaning to the dead entities or elements of the external world. The way of how the external world is presented to us as reality is guided by a conscious action or (with another term taken from Michael Polanyi [22]) structured by a sense-giving activity. But these activities are not completely free or voluntary as they are grounded on the need of the survival of our human species. If we can't cope with the external world because we have constructed a "false" (better: not valid) reality, then we will fail in our actions.

To summarize: The higher level guides or structures the lower level (the reality) but has to take into account the laws of all the elements of the lower level (the external world as a whole). Polanyi says the higher level is supported, e.g. scaffolding by the lower level. So the higher level regulates the lower levels but does not create or determine it completely.

On the other hand the higher level is not just the result of the sum of all the elements of the lower level. It is important to understand that the organization of the lower level (and this is far more than a simple addition) is essential for the emergence of the higher level and its concrete appearance. The elements of the lower level by itself can never constitute their higher level completely because they need a certain structure, a certain relationship among each other. The laws of these relationships cannot be found in the individual elements themselves.

What are the practical results of these philosophical considerations?

1. You can't deduce from individual educational interaction patterns which educational models they will be a part from. A specified interaction pattern can be part of different educational models.
2. You can't determine from an individual educational scenario which interaction patterns they are formed of. There are always different ways to look at the educational objective at hand, different ways to direct the torch into the dark (different lighted situation, differently enlightened situations).
3. The second level (interaction patterns) is the most interesting one as it has a double function: It works as lower level for the educational scenarios but at the same time as the higher level for the tools level.
4. And last but not least: Because of the interactive relationship between higher and lower level there is no best starting point for the above described categorization scheme. One can start with the lower level or with the higher one – this is just a matter of personal preferences. But after one has finished the description on one level to some detail one has to look for the higher (respectively lower) level in some details as well and trying to match, to fit these two levels to each other. This work has different levels of fine tuning, hopping from one level to the other and back.

3 Substantial Examples

3.1 Top Level (educational scenarios):

The description of historically relevant pedagogical learning models (with a special focus on dynamic approaches like problem-based learning, explorative learning, reflective learning) has to be based on literature and analytical study. Throughout the last 100 years instructional theory has developed many different educational models and learning scenarios. What we are still missing is not only an educationally sound and complete categorization scheme, but also the application of these models to the new forms and types of virtual learning environments.

This sound categorization scheme is not easy to elaborate and needs a revisited description and detailed survey of the historically relevant educational models. As a first starting point we can build on the previous work done by Norbert Meder in his scheme of "cooperative objects"[23].

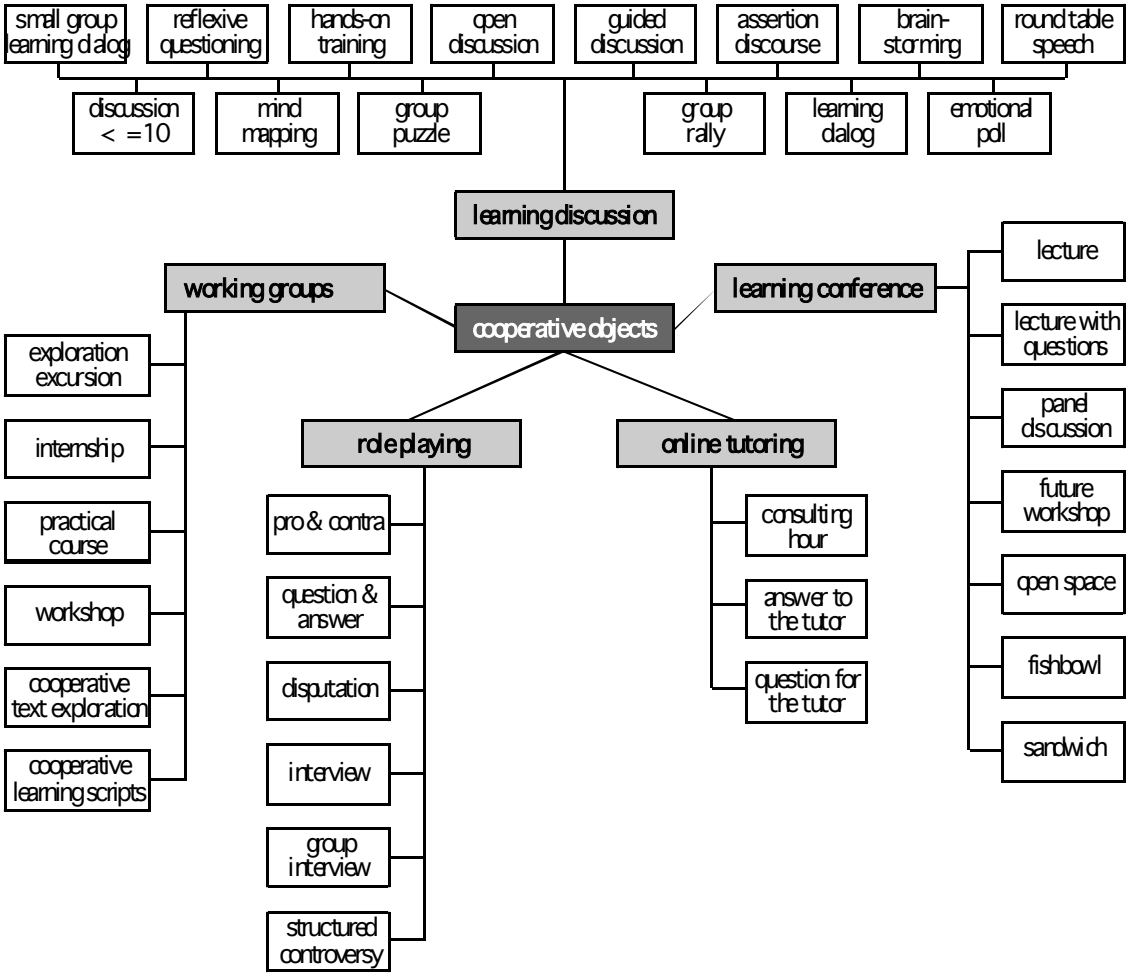

Fig.3: Didatical Ontology by Norbert Meder

3.2 Intermediate level (educational interaction patterns):

This level is perhaps the most interesting and relevant one, but it also still lacks the greatest amount of analytical description: As a first starting point we have identified over 62 educational interaction patterns [24]. We have published them for this conference on a special (multilingual) website [25]. (See also the accompanying article by Ingrid Bergner and Peter Baumgartner for this conference [26].)

At the time these patterns were elaborated the analysis was not influenced by the stratification theory explained before. Therefore the terminology in these descriptions is not theoretically sound. Sometimes the educational interaction patterns are called methods – a very general notion – which of course does not present us the picture and relationships we tried to provide with this article.

We think that there are still many more educational interaction patterns, maybe 200-300. In order to add these missing patterns we also need to explore those of which we already have a description. How do they fit into the educational scenarios and how many scenarios can we distinguish on the basis of these many different interaction patterns. In contrast to the traditional literature, which is mostly lacking in granularity, we think there are not only about 10 but maybe 30-60 types of scenarios, that need a more detailed description in the light of their underlying educational interaction patterns. Traditionally these educational scenarios lack detailed and finely granulated descriptions because there was (and still is) a huge divide between theoretical consideration and practical usage in the pedagogical models. Our chosen qualification to describe these scenarios under the terms of the underlying educational interactive patterns guarantees a much more detailed description.

For example the specific educational scenario "guided discussion". – as mentioned in the above diagram. We could define several interaction patterns for this scenario such as: to initiate a topic, to respond, to filter, to revise, to reorganize etc. One needs all these patterns in order to get a sound "guided discussion" scenario, which works in practical educational situations.

Some of these interaction patterns mentioned before form parts of other scenarios, but others do not. Take for instance brainstorming: In brainstorming you need the interaction pattern "to initiate a topic" like in the guided discussion, but "filtering" clearly is not part of the brainstorming scenario.

We can now reformulate our previous philosophical considerations:

- Not all combinations of patterns create meaningful scenarios. The relationship between patterns is a factor in a scenario too. The knowledge of the rules of every chessman does not make a good chess player.
- The educational interaction patterns make certain learning scenarios possible, but you cannot simply reduce the scenarios to the patterns, the scenarios "organize" the patterns into meaningful units.

3.3 Bottom level (tools):

The detailed evaluation of the tools we have already done can serve as a first starting point. But we have to reformulate the criteria and functionalities of the tools in order to comply with the new requirements. Independent of the positioning of the tool done by its producer or reseller is mainly market driven and many times does not fit an educational sound learning or teaching model. We have to find all those functionalities that form part of a specific

educational interaction pattern. Even if those functions are hidden, spread out over different parts of the software or just missing.

And with these constraints in mind (what and how does a specific functionality contribute that an educational interaction pattern can be executed) we will overcome the traditional and therefore predominant reference to the common sense knowledge in education. As Michael Polanyi pointed out several times in “Tacit Knowledge”: There is a contradiction in most of our learning processes: We learn many times through demonstrations by example, philosophically called deictical definitions. Whenever we point to something new (or to a new aspect of something) how can we be sure that our intention is understood and the right thing learned?

Take for instance the example to teach a child what a car is. In pointing to a car and muttering the word “car”: How do we know that the child does not believe that we mean the color of the car or its motion? This is a trivial example but the essence is that all learning by example is characterized by an under specification of the learning content. All learning by examples needs the assumption of an active intelligent conclusion by the learner itself. We cannot transmit knowledge one by one without the active participation of the learner who constructs his/her mental model.

In developing software tools we have now a unique possibility, which is also a new chance for the learning process: In order to work properly the developer has to specify very much in detail the required functions. Using this software is not only using a tool to manage a certain process, but also a learning tool to understand the world. It functions like the stick for the blind: A tool for exploring, understanding and managing the external world. Taking this parallel we can still go further: In order to understand and manage all different aspects of the reality one has to have the proper and adequate tool. For someone which only has a hammer the whole world looks like a nail.

The practical conclusion of this consideration is: There is no way around the fact that we will need different kinds of software tools for different learning objectives. These different tools are not the starting point for our learning processes and they are not to be confused with reality itself. They are just means to construct our reality, to shed light to certain aspects of the external world. Form their usage the reality we perceive emerges and we learn how to cope with the external world.

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