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## Types of learning?

A pedagogic hypothesis put to the test

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The learning type theory maintains that the (individual) learning performance of pupils is enhanced by taking into consideration the different “channels of perception”. This theory has become largely independent of its author *Frederic Vester*. It is being widely disseminated through publications and events of various kinds and has become extremely popular. Concepts of learning regarding this subsist therefore in the minds of pupils, students and last but not least teachers and academics who consider this problematic pedagogic construct plausible and keep on transmitting it uncritically.

An analysis of these concepts is particularly crucial because it is above all here that erroneous theories of learning and teaching can counteract the objective of improving classroom teaching and learning strategies. Also, the popularity of the learning type theory gives informative insight into how learning at school obviously often takes place.

By the way: The fact that some authors even refer to the learning type theory in publications on current constructivist didactics is from the point of view of subject-oriented learning almost to be expected, it draws new attention to the respective publications but it is to be criticized.

The more you study the statements on how taking learning types into consideration enhances learning effectiveness (including related pedagogic principles, see below) the more it strikes one that the soundness of this seemingly plausible correlation is normally assumed without further examination – and presents itself as common sense particularly in elementary school pedagogy but also in didactics of the sciences and others.

### 1. The learning types according to Vester

In essence, the learning type theory goes back to Frederic Vester. Therefore the following presentation of the theory refers to an extract (p 49-52) of the book “Denken, Lernen, Vergessen“ [Learning, Thinking Forgetting] by Vester, that was published in 1998 in already the 25. edition – nota bene as a new edition revised and updated (!) by the author. The book was first published in 1975. An educational film of the same contents can still be lent from most municipal media centers even today.

Let us take an authentic example of Vester to explain what learning types are: In his example the aim is to learn the physical law “pressure equals force divided by area”. The correlation between the physical quantities are to be *grasped* that is, the law should not just simply be learned by heart.

According to Vester this content – as, by the way, any material “independent of its degree of difficulty” (p. 49)\* – can be learned in different ways suitable for the different learning types of learners. Vester differentiates between 4 types:

- Learning type 1: auditive learning (“by listening and speaking“),
- Learning type 2: visual learning (“through the eyes, by watching“),
- Learning type 3: haptic learning (“by touching and feeling“),
- Learning type 4: learning through the intellect.

This kind of classification calls for a critical analysis. Learning type 1 to 3 differ in the kind of receptive channel (sensory mode) for an information. Logically the fourth type of learning does not fit into this category although this is exactly what Vester maintains when writing: “The content of the explanation is the same in all four cases: large area, small pressure; small area, big pressure. The only difference lies in the receptive channel.” (p. 51)

By classifying learner types in *this* way Vester denies the intellectual effort types 1 to 3 take reserving it exclusively to learner type 4 instead. On the other hand, Vester equates the perception of a phenomenon with the capacity to make abstractions in order to explain the phenomenon, i.e. perceiving = learning or understanding.

### 2. The logical mistakes

In order to assess and criticize the theory it can be examined first of all in terms of its inner logic alone without comparing it to theories of the cognitive science. The question therefore is: Can this content be understood in these different “ways of learning”?

Vester maintains: "The greater the variety of the kinds of explanations offered and the more channels of perception are used (...), the more firmly the knowledge is stored, the more diversely it is anchored and also understood, the larger the number of pupils who understand the subject matter and will remember it later on." (p. 51; highlighted by M.L.). Here it is needless to say that "kinds of explanation" are not identical with "channels of perception".

Auditively and visually the learning content (the physical law!) can be taken in as a mere sequence of letters and/or sounds (that is, in any form of verbal coding), haptically this can be done through Braille at the utmost. All this is merely the basis for learning or understanding information. From this point of view learning type 4 follows 1-3 and is indispensable for the understanding and, the other way around, the sheer information as a sequence of letters or sounds needs to find its way into the head of the learner in the first place.

If you look more closely into Verster's text you can read about the *auditive learning type* that here "misunderstandings ...are sorted out via argument and counter-argument, simple examples and drawings are devised by the learners themselves". Without doubt this achievement requires a cognitive effort. Moreover, this raises the question: Are handmade drawings not "haptic" in Vester's sense?

As regards the *visual type* it reads as follows: "Everybody knows from experience that a pointed and sharp nail penetrates the wall much easier than a blunt one. But why? Because of the enormous increase of pressure due to a minimal area of contact." You can perhaps see with your own eyes that a sharp nail penetrates the wall faster than a blunt one but the additional explanation is the result of cognitive processing. The explanation cannot be seen, no matter how hard you try.

As to the *haptic type* it says: "He or she takes two pencils, one with the point up, the other with its point down. Pressure of the thumb on the flat surface. No reaction. The same pressure onto the point. It hurts. Why? Because the point increases the pressure considerably due to its tiny area of contact and most noticeably so."

Apart from the fact that here the difference to the hammer and nail experiment does not become obvious at all, the thumb itself most certainly does not deliver the explanation for the phenomenon "pain by point of pencil" but again this is gained through intellectual processing. The law cannot be deduced from the action itself. The intellectual content of the formula can neither be seen nor touched. Therefore you cannot evade the intellectual effort to work out this content theoretically.

Grasping something abstractly is no alternative to touching it. Or else this would raise the question: If pupils cannot touch the subject matter will there be no way for it to enter their heads? But how then would it then be possible to learn grammar or understand the correlations in world economy or between AIDS and the immune system or the process of photosynthesis or the effects of drugs? Understanding any type of abstraction would be impossible. Thinking, feeling and acting are neither different options nor different methods of learning and understanding, they are completely different categories.

The *fourth type of learner* is said to grasp the formula in a more "abstract verbal way" i.e. "from the formula itself - even if it is full of abbreviations and 'units' as is the case here." This enormous ability calls for an explanation because the formula (this representation of the formula is currently uncommon) in Vester's text looks as follows (p. 50):

$$1 \text{ bar} = \frac{10^6 \text{ dyn}}{\text{cm}^2}$$

The learning type theory - as far as auditive and visual perception is concerned - might apply when it comes to merely memorizing and reproducing names, dates, facts because they do not require comprehension or touching. All mnemotechniques serve memorizing only - a concept of the subject matter is not necessary at all.

Yet a physical law in the form of a formula normally aims at its application. And that requires insight.

Vester's learner types 1 and 2 possibly memorize the formula (mere mental effort) without understanding it. Type 3 does not learn anything at all due to a total lack of the capacity for abstraction including the verbal coding of the formula. Also, linking the action with the formula can fail if its meaning is not clear to the learner.

### 3. Evidence from cognitive science?

Can cognitive science perhaps give evidence for or against such a learning type theory? The term and the construct of the “learning type” according to Vester can understandably not be found in cognitive science literature and discussion – a fact supporters of this theory seem to be totally oblivious to and is therefore evoking astonishment.

For a typological classification of learners the term *learning styles* is used at best: It is a cognitive style when a person makes use of similar strategies in different situations. Strategies in a narrow sense are stored in the memory as retrievable action plans (e.g. as a combination of tactics / techniques making up a plan for managing a problem). Cognitive learning strategies are among others repetition strategies, elaboration strategies (for the incorporation of new information into the existing knowledge structure, for example, analogies are created) or “critical examination” (e.g. thinking about alternatives to the statements and conclusions presented). It is to be emphasized that in contrast to the “learning types” described here these strategies are relatively complex constructs of knowledge gaining.

In addition to the logical deficiencies, Vester`s theories do not make differentiations that would have been necessary regarding cognitive science theories. Since Vester`s example is about declarative knowledge procedural knowledge is to be ignored in the following – as it has developed into its own branch of research. Vester does not consider this differentiation. The skill to hammer a nail into the wall is not what is supposed to be learned with Vester but the aim is a theoretical abstract understanding of a physical correlation (propositional knowledge). Learning of how to hit a nail into the wall can hardly be achieved without doing it “hands on” that is, by merely listening, watching, touching or even “purely intellectually”.

First of all it needs to be emphasized that the sensory data the learner receives when hearing something from the teacher or reading a text, looking at a picture or touching something do not have any intrinsic meaning. It is the learner who attaches meaning to the sensory data in the first place. This meaning is generated within the set of ideas that determines the learner's approach to the interpretation of the incoming sensory data. (see. Häussler et al. 1998, p. 171)

Let us look more closely at the visual learner type in connection with knowledge representation. The question is: Can the abstraction of the formula  $P=F/A$  be represented as a mental image, e.g., in the form of "hammer/nail"?

In the differentiation between *propositional and visual knowledge representation* it is significant that images cannot be put into a mental representation system *instead of* e.g. words or sentences. There is a fundamental difference between images and words or sentences. In contrast to abstract semantic or propositional representations images are analogue representations referring exclusively to visually detectable properties (also spatiality) (see. Wessells 1994, p. 294). Those properties that are not visually detectable or describe relations such as weight, family relations between persons on a photo remain unconsidered. These visually undetectable facts can also not be found in the visual representation and there is no process able of gathering such an interpretation from the image alone. (See. Rehkämper 1991, p.121).

The fact is: During visual perception we are able to see the surfaces of objects and their transformations directly. All the rest is neither the content of perception nor represented as a mental image. The same is true for haptic perception where only those things can be grasped which are accessible to this particular sense, that is, which make for an adequate stimulus.

This is also true for the phenomenon that mental images emerge as a visualization of the problem when solutions are to be found for - and *only* for – *vision and space-related* problems such as tasks concerning the mental rotation of objects.

An other issue which evokes the *use of mental images* is e.g.: Think of a house you know really well (maybe the house you live or grew up in). How many windows does this house have at the front?"

Mental images can be scrutinized and mentally rotated the same way as can be external objects but – as mentioned before – for the comprehension of the abstract formula  $P=F/A$  the representation of the hammer/nail image will hardly be sufficient because comprehending is first of all an effort for meaning therefore semantic information processing has the key role. Although representation forms were dealt with here only very briefly cognitive science as a whole does not give any evidence for the learning type theory.

#### 4. The learning type theory and learning through all senses – holistic and action-oriented?

The wide dissemination of the theory of learning types makes the study of this theory so relevant and necessary. Its persistent popularity is being fuelled by the current pedagogic trend of “action-oriented” and “holistic learning” as well as “learning through all senses”. Since practicing teachers do hardly or never read scientific literature (any more) according to studies (see. e.g.. Looss 1998) but instead rely on practice-oriented approaches, e.g. in the form of How-to literature (see below) the wide dissemination seems alarming. The impact of *this* theory on the concepts of learning of teachers and pupils might therefore be more relevant than scientific theories.

In proverbs, words of “great thinkers on education”, specialist didactics, biology schoolbooks, books on “learning how to learn”, methodology handbooks and practice guidebooks even in biology textbooks and last but not least in curricula and current pedagogic journals this kind of learning theories can be found. An overview and a small selection of references in literature and their criticism can be found in Looss (1997). Apart from articles on the subject a look into programmes of further education for teachers is very insightful as far as the dissemination is concerned.

The author’s own study on students of the school subject biology (most of the 21 respondents were students at the end of the second semester – summer term 1999) showed that 15 of 21 students knew the theory of “visual, haptic, auditive learner types” and considered it as being correct. Several respondents would want to devise lessons on the basis of this theory. Also, asked previously in how far people have different learning styles (in case this was an agreed opinion at all) the respondents went mostly into these learner types and the asymmetry of the brain hemispheres (example of quote: “Children who get to see a lot learn more through visual perception while others who have read a lot learn better on a cognitive level”). In addition, there were statements such as “some people learn more theoretically, others more practically” etc.

The presented evidence about the dissemination of the learning type theory shows that there is a considerable need for academic teachers to take action....

The attempt to differentiate in terms of terminology and contents between the learner type theory and “learning through all senses”, “holistic learning” and “action-oriented learning” seems appropriate if you intend to acknowledge one or the other aspect. For information on the historical development of the different approaches be referred to the literature indicated.

##### 4.1 *Learning through all senses*

“Learning through all senses” is particularly popular in elementary school didactics and according to Segerer (1999, p. 4) it is “today more than ever an indispensable pedagogic principle”. Here, the link to the learning type construct is the most evident. Very often sensory experience, sensory perception and learning are equated with each other and Vester’s concept of the learning types is adopted (see e.g. Wendler 1998, p. 539; s.a. Zitzlsperger 1995). Also a relationship is often established here to action-oriented teaching, as children use “their different senses when actively dealing with the subject matter (...)” (Wendler 1998, p. 541 under reference to Gudjons 1989, p 50). As an example for learning through all senses Wendler advocates that children should walk barefoot over forms of letters lying on the floor as to absorb information about the letter to be newly learned via the skin, the equilibrium as well as muscle and joint receptors.

The sometimes somewhat forced effort to stimulate all senses in the different lessons becomes obvious e.g. in the publication of Engelhardt (1991) where by cooking international dishes during the geography (!) lesson taste and smell are supposed to increase insights into the different countries.

##### 4.2 *Holistic learning*

In addition to the complexity and the multiple layers of the meaning of the term “holism” (see, e.g. Haarmann 1998, p. 64-71) you can find as regards “holistic learning” the following requirement: In delimitation to a lack of immediacy towards the subject matter caused also by ex-cathedra teaching a key demand of a comprehensive holistic education is that for active knowledge acquisition through direct engagement with the subject matter. (ibid., p. 68). “Holistic” is here understood in the sense of “hands-on” “and is thus (?; M.L.) supposed to lead directly to a cognitive understanding of the subject matter”. The connection to the learning type theory becomes obvious and Haarmann deliberately makes it by referring to “more recent learning psychologists such as Piaget, Aebli, Bruner and Vester“ (!). A direct link is apparent also with

Zitzlsperger (1995) not only in the title of his book („Ganzheitliches Lernen – Welterschließung über alle Sinne mit Beispielen aus dem Elementarbereich“)[Holistic learning – deciphering the world by using all senses with examples from elementary school teaching], but a direct connection to Verster’s learning types is also made. (p 188 f).

There are no objections against the “direct engagement with the subject matter” however, no distinction is made neither in “learning through all senses” nor in “holistic learning” – the same as with the learning types as well – between the mere prerequisites of learning (senses) on the one hand and the cognitive processing which is indispensable for comprehension on the other hand. Instead, “learning through all senses” etc. is viewed as an alternative to cognitive learning in the respective theories.

### 4.3 *Action-oriented learning*

This approach also considers itself to be an alternative to “cognition-dominated ex-cathedra teaching” (Bönsch 1998, p 72; cf. also Jank/Meyer 1994, p 337f) and is at present worked out particularly by Hilbert Meyer and Herbert Gudjons. Bönsch states that there is a conglomerate of aspects the combination of which he considers inappropriate since it blurs the clarity of the concept. Action-oriented learning has “cognitive, emotional and practical aspects (the traditional Pestalozzi trilogy of head, heart and hand), is related to life and the situation, focuses on the interests of the participants, triggers responsibility, stimulates many senses, encourages social learning.” Bönsch urges to differentiate particularly between “practical learning” and “action-oriented learning”. Action-oriented learning includes and should always do so cognitive elements apart from practical activities. This is also pointed out by Jank/Meyer (1994, p. 338) in anticipation of critical objections which might find in this notion acting to be a surrogate of thinking. But how does the cognitive effort manifest itself here? Planning, execution, result and evaluation of the action comprise cognitive elements: “Thinking, discussing, planning, managing the execution, evaluating the results” (Bönsch 1998, p. 72). This is a highly abstract form of action which is not to be carried out without thinking at the same time. Put aside the question of what the actual objective of the learning process is supposed to be (particularly since the focus of the lesson is supposed to be on making an actual product in the course of the activity) and of how it is supposed to be possible to understand abstractions (even from the action that is in fact being carried out) in an action-oriented way, it is only under the premise of cognitive processing that “action oriented learning” can be delimited from mere action for the sake of action. Various publications show that this objective is often only a lip service and that the term “action-oriented” has become a buzzword narrowing it down to practical action only. As already Jank/Meyer (p 354) have stated, this is a more “naïve emphatic” way of using the term, insinuating that its use already guarantees the quality of the teaching concept labeled that way.

Jank/Meyer are quite frank when admitting the intention to fight last but not least boredom (of pupils) and problems in maintaining discipline (of teachers) in the classroom with action-oriented instruction. As mentioned before and amplified below, fun in class cannot substitute sometimes rather tiresome reflection.

The boundaries to “holistic learning” are blurred because according to Bönsch (1998, p. 73) and Jank/Meyer (1994, p. 338) the underlying concept of “action-oriented learning” aims at “holistic learning allowing the learner to fully engage as a person (head – heart – hand – all senses) in the learning process.”

So it is obvious that in the literature there is no clear distinction between the terms except for some minor deviations or additions if any. Consequently, the lines of argumentation presented here need to be analyzed just as critically. The presented criticism of the learning type theory can be applied to related approaches that argue similarly.

Due to the undiminished popularity of an argument - often alleged as scientifically proofed against the criticism of learning types and related approaches – the following may be added: According to supposedly empirical studies (the source of which cannot be identified, however) we remember 10% of what we have read, 20% of what we have heard, 30% of what we have seen, 50% of what we have heard and seen, 70% of what we voice ourselves and 90% of what we carry out ourselves.

The criticism of this popular listing (which comes up almost just as often in relation to learning and “action-orientation” as the learning types) can in parts follow similar lines of argumentation as the criticism of Vester’s theory. Apart from the fact that there is no way of identifying how these findings were gained they obviously seem to deal with the total sets of information which eventually settle in our long-term memory -

independent of whether we want to remember or do not. The act of remembering seems also to be independent of the degree to which the information is processed and the significance attributed to it. Moreover, these findings can only be regarded as convincing if pure memorizing is equaled with learning – independent of whether a content has been understood. The specification of percentages merely suggests that there is a link particularly the one that theoretical insight can best be gained through practical experience. Here, a short reference to people who have obviously not learned from experience should suffice as an objection.

Some comments need to be made regarding the often not only in biology didactics cited connection between “learning through all senses” and experimenting in class. You could also point out “action-orientation” here which is regarded just as “holistic learning” and is therefore considered to be particularly effective (see above). So the statement that experiments alone can facilitate understanding with pupils should be met with skepticism. There is no doubt, that a lesson during which the pupils can do practical work is more fun for them and keeps them motivated. The appeal of event-oriented hands-on museums or interactive science centers speaks for itself - as far as fun is concerned.

Learning success occurs however only if the pupils themselves draw the right conclusions from the experiment. Then it is more likely that they remember the learning matter than if they were only just told the result. Learning through reflection! But also incorrect conclusions might be drawn from experiments. Again, the error lies also in the thought and not in incorrect vision, feeling and touching or hearing.

Gaining chemical, biological or other insight from experiments is based on a necessary interest in these insights that is separated from the actual doing and is based also on relevant previous knowledge and – last but not least - on cognitive processing. Learning is more than the undoubtedly necessary use of the senses (e.g. in the experiment) and more than the sensory experience itself. Explanations require the very distancing from the immediate experience. The efficiency of learning depends on the *cognitive* activities of the learner rather than on the practical ones.

There are hardly any grounds for the expectation or hope that practical doing motivates pupils to abstract thinking and that they subsequently are eager to learn and understand what the law says. Everybody makes a decision on what he or she wants to learn, remember or recall. This requires subjective significance and interest as well as a considerable degree of attention. There is no way you can force this preparedness for learning from anybody.

## **5. Classroom learning – only storing and reproducing?**

The popularity of Vester’s learning theory and its variants can give some insight into the way in which pupils’ minds are strained during classroom learning.

Since pupils learn in order to get good marks, “understanding” of a thought expressed (by the teacher) is in fact often limited to its reproductability. Examining an idea in terms of its plausibility is not part of the agenda.

Very often the forms of acquiring knowledge are limited to the use of the memory even as regards subjects where this is not appropriate. It is true that learning vocabulary like for instance the English word for table and chair can only be memorized not deduced. Understanding and remembering are key differences already in math. This is what pupils experience in their next test at the latest if they have learned a formula or a mathematic proof by heart rather than having tried to really understand it.

Since in standard tests more in-depth knowledge is not required but much rather the fast and reliable reproduction of facts and solution patterns pupils might even be more successful when adopting the less demanding *surface strategies* to get a good mark. Therefore in-depth mental processing does not necessarily generate better classroom performance (in the form of marks). The requirement of the learning environment determines the learning orientation.

These assumptions about the current requirements with respect to classroom performance match the findings of the *TIMS-Study* (cf. Baumert et al. 1997). It is significant that German pupils are relatively effective in solving routine tasks and reproducing factual knowledge. They fail, however, in solving more complex, cognitively demanding tasks requiring conceptual understanding or flexible application of know-

ledge. In addition, deficits in problem-solving as well as scientific thinking and reasoning skills become apparent.

There are hardly any surveys to date on the subjective theories teachers and pupils hold or on the relationship between their everyday concepts about learning and scientific learning theories. A study by *Schletter and Bayrhuber* (1998) on pupils' ideas about the subject "learning and memory" and its neurobiological and psychological principles provides significant hints which support hypotheses about the kinds of requirements of classroom learning. Individual results of the study showed that concepts of what classroom learning is about are characterized as remembering (storing) and reproduction (unmodified reproduction) of knowledge (scientific insights).

When asked how they prepared for written tests, respondents claimed to apply mainly reproductive learning strategies. Only very few take the effort to restructure actively the contents to be newly learned and, consequently, make understanding easier. Interestingly, information processing with the respondents ( $n = 20$ ; specialized course biology, upper secondary level) is confined to sorting and storing of what is absorbed through the senses: "Accordingly, in the view of almost two thirds of the pupils information flows directly from the outside world via the sense organs into the short term memory and afterwards into the long-term memory" (p. 26). Last but not least the experiences pupils make with school tests may well be responsible for their belief that further processing of information through thinking processes might be less important for learning since the reproduction of learned contents seems to be key for passing tests.

In addition, the concept of memory molecules as an information store described also in this study is prevalent - and can still be found in the updated (!) 25. edition of "Denken, Lernen, Vergessen" [Learning, Thinking Forgetting] (Vester 1998).

From these analyses the popularity can be explained of Verster's theory and of books on "learning to learn" containing mainly mnemotechniques as well as details about the management of resources. And the reader does not expect anything but tips and tricks of how to memorize as much information as possible in such a way as to reproduce it "blindly" at least until the next test. This is where these books can actually be of real assistance (Useful books regarding this and can do without learning types are e.g.: Adl-Amini 1989, Endres et al. 1994, Miller 1993).

Also teachers know that this is the way how things are. However, the selection function of schools is considered by many critical pedagogues as an unpleasant side effect rather than the yardstick of learning at school. And so they try hard to exercise as much justice as possible. To this end the learning types seem an apt and just tool. A lot of effort is put into experiencing and having fun and stimulating every sense, that is learning through all senses. And it is not surprising that an olfactory learning type can be found in literature.

The differences in the achievement levels that still occur call for an explanation. But be it as it may: In any case as a teacher your mind can be at rest because you know about the different "basic patterns" of perception and learning and you have taken the effort of "broadcasting" on different "wavelengths". However, hardly any criticism of this theory can be heard and of pupils' learning effort that aims only at achieving the required marks.

Let us assume the good intentions of teachers to help pupils and to do justice to all pupils. In view of what effects these theories might have on pupils their wide dissemination is very disconcerting if not disastrous indeed: Must pupils not be completely disheartened if they are not able to see how biological, physical and other knowledge grow quasi "naturally" from practical action although they are told that this is exactly the case? How will the pupils who are most reflective not come to the conclusion that they are not talented enough to acquire this knowledge? Do pupils not have to despair of the fact that they cannot think of any action at all which might enable them to at least remember the knowledge they have not understood?

## **6. Alternatives?**

The question is: What promotes understanding-oriented knowledge acquisition? Unfortunately there has been no explanation to date of precisely how understanding of a learning contents comes about? According to the present standard of knowledge there is no simple structure and also no ideal way of promoting efficient learning and thinking (cf. Reusser 1998, p. 129).

All conclusions drawn from empirical studies for possibly more effective forms of teaching can only be mere indications whose effectiveness needs to be examined in the overall context. Approaches to promoting an understanding-oriented knowledge acquisition need to take into account that it is an active, motivated, constructive, in parts a self-directed process which is embedded in a particular situation and social context.

As regards the individual determinants of school performance it is the expertise research of the past years and the latest constructivist approaches in particular which consider *task-specific and field-specific previous knowledge and/or pre-lesson concepts* to be most predictive (cf. Helmke/Schrader 1998, p 60; Duit/Treagust 1998). On the whole cognitive, volitional and emotional-motivational characteristics of a person concur in the individual construction of knowledge.

*A résumé of the findings of the research*, models and theories on making schooling more effective with regard to teaching that focuses on understanding shows that apart from taking into consideration pre-lesson knowledge, influencing the interest and motivation has the greatest impact as a prerequisite of deeper processing and as a function of personal and situation-related factors. (cf. Krapp 1993, Krapp 1998).

As regards *constructivist learning environments* (according to an adaptive instruction model) there are four criteria (cf. Duit 1995) which at the same time can be regarded as promoting motivation: The lesson should...

- ... give the pupils opportunities for meaningful and self-directed working and for thoughts independent of teachers and other pupils (i.e. "allow space for individual knowledge construction")
- ... give the pupils the opportunity to link their previous knowledge and their previous experiences with the matter to be newly learned ( that is also to take the self-explanatory effect into account)
- ... give the pupils the opportunity for interaction to negotiate meanings and find consensus
- ... give the pupils opportunities to experience learning as a process allowing them to solve problems they personally find difficult (that is, to enhance self-efficiency in a particular field, e.g. by setting appropriate tasks, by developing efficient learning and problem-solving strategies).

Moreover, pupils ought to build their knowledge from complex, realistic problems in authentic situations (keyword: situated learning). By creating multiple contexts the learners should be able to transfer their knowledge in a flexible way to other problems. Through multiple perspectives the learners should be enabled to view the same problem from different angles considering different aspects. On the whole, the aim is to build knowledge that is understood and can be applied. This also means: linking the contents of teaching to the interests as well as the pupils' world of experience and living and imparting knowledge, competences and skills pupils can connect with their own practical life, i.e. also making use of these skills and gaining competencies (cf. also Dubs 1995, Häussler et al. 1998).

The problem which occurs in implementing these kinds of instruction models lies in the dramatic lack of time leading or forcing teachers to apply more direct teaching methods. The teachers are, however, neither forced to accept these circumstances without criticism nor forced to believe everything the learning type theory promises...

*\*All quotes translated by the author*

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