

Angelika Speck-Hamdan

# How children learn

## The construction of the world in children's heads

**Learning is an active process of construction. Television programmes can provide children with a suitable learning environment provided they succeed in arousing children's interest, offer features they can relate to, and support them in the learning process.**

As commonly maintained by child development psychologists today, learning commences with birth, at the latest. Babies learn how to distinguish the voices of people they know from those they do not, they learn how to walk, speak and use simple tools. Young children learn how to use a phone, play with others, count, operate the remote control of the TV as well as many other things. Advancing very rapidly throughout early childhood, learning processes can be very clearly observed from the outside. Children at this age are learners of the highest calibre. They acquire knowledge and skills. They develop theories about the world and test them against the backdrop of their experience.

Learning is a part of life and develops in divergent patterns: contextual, primarily self-directed learning evolves during participation in daily life; school learning is planned and pre-determined; while other learning may develop due to the child's own impulses, for example when he or she practices at developing individual skills and abilities or pursues special interests. When children start school,

the contextual or incidental learning that is dominant in the pre-school period is supplemented by systematic learning linked to prescribed content. However, school does not always succeed in maintaining beginning pupils' generally high level of motivation for learning or in transferring it to learning of the school curriculum.

### What happens during the learning process?

We now understand a little more about the process of learning from research of the brain. We know that the brain constantly processes an undeterminable amount of information (approximately 100 megabytes per second of input and around 50 megabytes of output per second) that enters and leaves via a total of four million nerve fibres (cf. Spitzer 2002, p. 54). Each of these links to the outside world is joined by a further 10 million interior links, ensuring that information is adequately processed internally. Such effective processing is attributable to the network of neurons, and especially to the strength of the synaptic links. The learning process effects what may be referred to as a channelling of linkages. The intensity of the use of such channels is expressed in the knowledge and ability of the individual.

Thus, the brain learns from experiences that are the product of the individual's interaction with the outside world. A particularly astonishing but easily comprehensible feature of this

process is the brain's ability to adapt to those interactions and to develop more intensively when it is utilised. Hence, it is by no means an inflexible, static organ. This explains, for example, why the brains of London taxi drivers are different from those of other people. Spitzer considers it to be "not improbable that the enlargement of the hippocampus in the case of London taxi drivers is linked to their job of finding their way through the London maze of traffic" (Spitzer 2002, p. 32). When transferred to understanding children's learning, these findings illustrate very well the importance of a wide variety of stimulations and constantly recurring exercises.

*The brain learns through experiences resulting from exchanges with the outside world*

Brain research findings support the constructivist approach to learning preferred by modern pedagogy. According to this paradigm, learning is the result of an exchange between an individual and his/her environment, the exchange being referred to as experience. At the hub of the constructivist approach is not the contents of what is learned, but rather the learner. As learners interact with the world, they master it step by step. As they do so, information entering the brain is received, processed and accommodated in the existent cognitive system. The result is that individuals produce

their own image of the world, so to speak. It may even be said that the world/outside reality is (re)constructed in the learner's head.

This interpretation has many intellectual roots. Particularly significant is the cognitive theory of constructivism that deals in a similar manner with the relationship between experience and the real world. An interesting dilemma is that no one can determine whether the real world and experience coincide.

"We glean our knowledge from experience; we can experiment with this knowledge within our experience and actually test it, but in the world we assume to be the basis of our experiences, we are unable to establish its validity. If we had reliable clues that experience does in fact mirror the real world objectively, we could probably forgo the need for proof. But there are many indications that our mode of perception and understanding actually determines what we experience" (Glaserfeld, 1999, p. 5).

Thus, it can be said that everyone constructs the world for themselves on the basis of their own possibilities of perception and understanding. This theory can be corroborated by a number of experiments. Further, it explains the well-known phenomenon that the same factual content is perceived differently by different people.

In my view, the most important consequence of this perspective, one that emphasises individuality and subjectivity, is the need for communication. Only by means of communication is it possible to create an approximation of common knowledge and agreement on evaluations. This is exactly what happens in the learning process: experiences are categorised, processed and during communication with others they are linked to general knowledge. As a result, we know what we are talking about with each other, even though we perceive and recognise things in different ways. Communication hinges on common symbols, language, images, figures

etc., the interpretation of which is agreed upon in such interchanges.

### Characteristics of learning

Learning takes place in the learner's head, invisible to the outside. An awareness of certain characteristics of the learning process is therefore necessary in order to design teaching-learning situations.

- *Learning is an individual process.*

Every learner processes experiences in his or her own way. Processing is ground in pre-experiences as well as different perceptions and processing strategies. Paths of learning and possibly the results of the learning process are not identical for individuals, either. For example, when confronted with a mathematical problem to calculate the area of an object, a child who is not yet familiar with multiplication perhaps will find a solution by adding together sections of the area, or alternatively, by laying them side by side, etc. Similarly, children often interpret a new, unknown word in a variety of ways, generally using familiar meanings as a guide.

- *Learning is an active process.*

Learning is a mental activity. Knowledge is acquired in the active process of coming to terms with the environment or the subject of learning. This may take place through a manual activity, active listening or the mental process of drawing conclusions. The activity does not have to be visible to the outside. The modern technique of image-producing procedures in brain research can however reveal this activity and make it visible.

- *Learning is a constructive process.*

In the learning process, new information is processed on the basis of already existing patterns or

structures. The world is thus assembled in the learner's head; in a sense, we could say that it is (re)-constructed. Activating paths and tools applied in previous learning experiences, a learner's "theories" are developed, tested, discarded or confirmed. One example that clearly illustrates this process of theory formation is learning a written language. Initially, learners apply their theory that "the spoken language is made visible by the use of characters" followed by the more elaborate theory that "individual letters can be attributed to individual sounds". However, additional experiences fail to substantiate this theory, so that it has to be replaced by an alternative that takes spelling conventions into account. Initially, some letters are put on the paper for the child to "read" and meaning is attributed to them. The written product is not legible to others, but results in agreement on the convention of the characters, if a more experienced learner such as a parent or teacher provides assistance. It is also recognised that letters depict sounds. In the next stage clearly defined sounds are heard and put into writing. The consequence is so-called skeleton spellings ("HT" or "HNT"). Later the complete writing of words is achieved based on what is heard ("FARVA" or "BURD"). Feedback leads to correction, for what can be heard is not always written down in the same way (here: "FATHER" and "BIRD"). Using this rule, the child subsequently writes "SOFER" and "BANANER", as it overgeneralises. Now it has to relearn all over again, accepting that there are not only rules, but also exceptions.

- *Learning is an accumulative process.*

New experiences have to be integrated into existing knowledge and processed by means of existing structures. Since new

knowledge relates to existing knowledge, prior knowledge plays a crucial role. The more strongly and more securely it is possible to build on these structures, the better the conditions for further differentiation and consolidation. Thus, someone who knows something about astrophysics can handle information about the thrust of the individual rocket stages better than someone who has just started to think about what happens in space.

- *Learning is self-regulated.* Learners are not simple machines that process experiences in every case in the same predictable manner. They are managers of their own learning processes. They can allow themselves to become involved in their own learning processes or simply refuse to do so. They go about their own ways of processing in ways that are linked to their personal learning biography. In any event, the autonomy of the learner is an important factor; sometimes it is diametrically opposed to instructors' teaching goals.
- *Learning is a socially environmentally embedded process.* Learning takes place in real-life situations. The experiences arising from them are inevitably complex. They trigger more than just the development of cognitive structures. Social and environmental contexts also influence the processing and utilisation of information, and so play a major role in the child's motivation to learn. If pleasant, such conditions increase the probability of successful learning. No child learns well when under pressure.

### **How learning can be stimulated and supported**

These observations reveal a number of conclusions about learning. First

and foremost, the subject of learning is not precisely mirrored – as a copy, so to speak – in the learner's thinking. The learners themselves, each of whom has their own faculties, are invariably the decisive factor in the learning process and its outcome. For example, one child will learn useful information about fear that may make even dangerous robbers act rashly from the "Bremen Town Musicians", a fairy tale by the Brothers Grimm. This may help him or her cope with anxiety. However, another child may be particularly moved by the wretchedness of the four protagonists – the donkey, the hound, the cat and the rooster – and develop an interest in protecting animals. Identical experience opportunities do not necessarily lead to the same learning results. This does not ease teachers' tasks for they must anticipate the differences in the learners. If they are schoolteachers, they also have to make sure that all the children or young people achieve a common, general level of knowledge, as prescribed by school curricula.

The most difficult challenge for teachers and for all those involved in the transmission of knowledge consists of wanting to influence processes that, generally, deflect intervention by third parties. This process is countered by a fundamental disposition of human nature to permit such influence. That is, human beings – particularly children and young people – have an innate need to comprehend the world and everything within it in order to undertake successful action. Since not all subjects can be self-accessed, most need to be imparted or taught. Here communication enters the scene. Anyone seeking to understand the world has to ask questions and this requires communication. Hence the most important task of the instructor or teacher is to create a communication situation in which the learners are supported in their individual learning processes. The former cannot do the learning for the learn-

ers, but they can stimulate and assist the process. In addition, they can influence the contexts in which learning experiences are accumulated. A positive atmosphere, in which learners feel they are taken seriously and enjoy learning, is bound to motivate them.

*Those who wish  
to understand the world  
must ask questions  
and get involved  
in communication.*

The consequence of this assessment for the school is that classical pupil and teacher roles must change. Teachers who have realised that knowledge cannot be drummed into their pupils' heads have learned to encourage them to make their own discoveries. They design their teaching less to transmitting specific, direct information and more towards appropriate ordering and linking of understandings. They adjust teaching activities to match children's individual learning processes. That is, such teachers do not force learners to adapt to their polished standardised teaching programmes. Therefore, the task of initiating learning processes for children is achieved, primarily, by the creation of a stimulating, appropriate learning environment. In the context of the school, the didactic setting is usually the classroom. However, features that comprise a setting designed to stimulate and support learning may well be transferred to other learning environments – for example television.

In summary, the potential for learning is maximalised by processes that

- stimulate children's or young people's curiosity,
- are directed to problem-solving,
- offer several perspectives,
- enable different types of learning,
- allow several paths to learning or solutions,
- feature varying levels of difficulty.



Such processes must be adequately complex to provide for the variety of individual paths of learning, but must not place too many demands on the learners. The learners must be permitted to find their own way in the environment, autonomously, or at least they must know how to find their bearings. This increases their own willingness to become involved in new experiences.

Learning environments vary greatly, it must be said. The learning environment in the home, the most familiar environment for the learner, is not designed along pedagogic lines, but doubtlessly offers an extremely wide range of learning stimuli. Here children learn what is hot, cold, warm, wet, dry, rough, hard and soft, etc. They learn about the functions of a door, a wall, a cupboard, a table, a chair, a bathtub, a telephone, etc. Here they learn to speak, run, climb stairs, count, etc. On the other hand, the learning environment in a classroom is designed according to pedagogic

of a meadow in bloom means waiting for a certain period. Each of these learning environments is relatively complex. They provide extensive learning opportunities, some social and spontaneous. Conversely, virtual learning environments are often intensively pre-structured. This mainly applies to computer learning games, which admittedly offer different levels of difficulty, but seldom several perspectives or individual paths of learning.

#### **Television – a learning environment of a special kind**

How can the learning environment of television be understood in this context? *Knowledge* programmes claim they stimulate children to learn and support them in their process of individually constructing the world. They justify this by claiming they are geared to children's issues and ac-

criteria and deliberately contains predetermined learning stimuli, such as atlases, books, learning games, card files, posters, boxes of experiments, as well as the arrangement for the lessons generally. The natural environment provides learning opportunities that are only partly predictable. The chance to observe a butterfly or a deer can only be planned to a certain extent; the experience

cordingly explain the world or individual phenomena, using the instruments available to television.

The comparison between school and television should not be overtaxed, but it must be realised that the means available to television are in some respects more attractive than those of a teacher. Indeed, some persons working in education regard television as genuine competition. On the other hand, school lessons cannot be zapped away; yet, unlike television, they are not subject to the constant pressure of ratings. Television is optional whereas lessons are compulsory. However, as learning environments, both school and television have the same goal – they seek to promote learning.

Therefore, both have to aspire to an optimal design. The fact that the learners have to learn for themselves also applies to television. Here producers of television for young learners are at a disadvantage since there is no review of learning success, a process that is so important for the further planning of teaching and learning processes. Further, television operates at random and is aimed at a fictive target group. There is no immediate and constant feedback in the form of children's or young people's reactions. The programme producers just have to trust that their intentions will be recognised, their endeavours to explain accepted and their proposed path of learning pursued. Learners will only seriously consider the knowledge programmes offer if their interests are catered for. Thus, television programmers feel that they must spare no effort to create stimuli relatively fast in order to arouse children's interests: "relatively fast" simply because the button for switching to the next channel is quickly pressed, and "interesting" stimuli because the viewers have to cross the threshold of getting involved in the learning process. Successful learning is largely dependent on whether the new information ex-

tends already existing information. This requires that televised instructional programmes must tune into what the children already know. Producers know even less about this subject because they are not acquainted with individual learners.

All the design principles required for provision of a supportive learning environment cannot be applied in a *knowledge* programme. Direct communication that is so important for learning is missing, though protagonists as well as presenters or characters who “accompany” the viewers seek to be surrogates. As noted above, direct feedback about learner engagement is absent. Indeed, all producers can do is surmise as to whether the message has been received. Direct learning support is not possible, since the learners cannot be observed in situ.

Aside from these reservations, television producers in developing the medium as a learning environment can apply several principles:

- embed learning stimuli in contexts that are relevant and meaningful in children’s lives,
- provide a clear structure,
- provide varied opportunities for connecting to prior knowledge,
- create error-friendliness,
- foster learner autonomy,
- stimulate meta-cognitive reflection.

Embedding learning stimuli that are meaningful for viewers increases the possibility of incorporating new knowledge into already acquired knowledge. This in turn raises the probability of retention. Knowledge does not become so-called “inert knowledge”. The reality constructed by television in *knowledge* programmes is not identical, however, to the reality of the individual life environments of viewers. Therefore television must generate the authenticity required by its own means. A clear structure provides viewers with the orientation necessary for accommodating new knowledge and useful as-

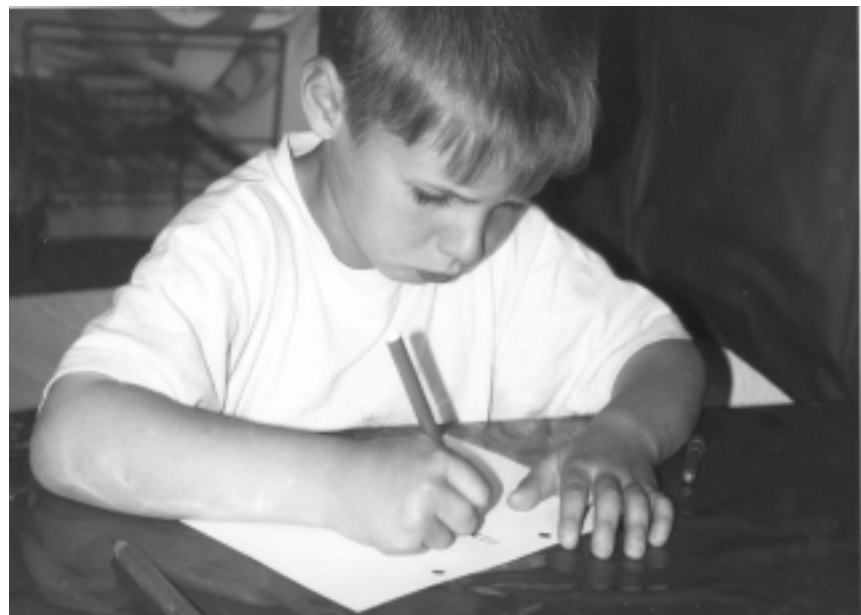
sistance in the processing stage. Further, it is particularly important in complex situations. Provision of a variety of opportunities for engaging in the learning process will take into account differences in the learners’ levels and styles of learning; the former enables every learner to discover the point at which he or she is able to engage in the active process of knowledge construction. Error-friendliness means adopting an attitude acknowledging that making mistakes is an integral part of the learning process and an opportunity for reflection. While television programmes cannot transmit this attitude on the individual level, they can express the desirability of adopting this attitude in general. To foster learners’ autonomy requires providing sufficient space for self-directed learning; learners are thus shown that their subjectivity and individuality are taken seriously. It is not as easy to render this space visible on television as it is in the context of the classroom. Sometimes it is created solely by refraining from giving the solutions immediately, by providing intervals for finding solutions and by allowing suppositions to be made. Finally, while there are limits to meta-cognitive reflection during a television

programme, it can be, first, stimulated by repeatedly referring to the different ways there are to approach learning and, second, acknowledged when it has been achieved. Similarly, since provision of direct help and support, so decisive for advancing learning, is not accessible, it is vital that support provided be accomplished in a manner that does not embarrass the learner seeking help and advice (i. e. by applying the principle of error-friendliness).

### What are the crucial elements of learning with television?

*Knowledge* programmes should fulfill three crucial requirements in order to maximise the potential for successful learning. Admittedly, these are relatively easy to explain, but relatively difficult to realise:

1. *The programme must stimulate learning.* A television programme must elicit and maintain interest in order to involve the children. Young viewers make their decision about viewing preference in the first few seconds of a programme. If there is a personal inter-



est in the subject, this serves as intrinsic motivation and buoys the interest for the moment. Beyond this, viewer-learners want to see how the programme is related to their areas of interest. In this regard, there is a risk that the programme may fall short of viewers' existing level of knowledge. If from the learners' perspective, banal elements are offered, their interest will wane. If interest in a subject has initially to be aroused, then offering a question that will challenge or maintain interest is often sufficient to lead to what is called "perturbation", an intervention intended to disrupt existing knowledge. Initiating such an intervention suggests that there is a solution to the question that will lead to an increase in knowledge. Another way to arouse interest is to exploit an existing relationship with the main characters or protagonists. For example, a character's popularity can be used to draw the viewers' attention to new subject areas that will lead to additions being made to the viewers' knowledge.

2. *The programme should supply many different opportunities for linking to individual learning processes.* The opportunities offered have to be consciously included in the programme's conception. They are geared to both the factual structure of the subject matter and the learning processes anticipated. Here producers of learning programmes must take into consideration not only the nature and level of viewers' prior knowledge, but also their likely styles of cognition and learning. For example, various explanations of a phenomenon can be offered in parallel or subsequent to the presentation. The type of question offered, too, can be varied. In short, a television programme – with multiple protagonists, different presenters, changing camera an-

gles, with alterations in the narrator perspective, etc. – has a whole repertoire of options that can be applied in order to provide a variety of learning opportunities.

3. *The programme has to structure possible learning paths in advance.* Producers must plan the development of the programme so that it will accompany and support, step by step, the construction taking place in the learner's mind. By means of clear structuring and delineation of the intermediate steps, the subject to be learned is divided into palatable pieces and processed in a manner that enables development of related knowledge according to the principle of accumulative learning. In this regard, while the factual nature of the subject may be easier to structure into the programme, producers must also take into consideration the presence of a heterogeneous audience. While providing for individual differences may be next to impossible, TV producers can take into consideration the general nature of development and learning for the target audience and, using this as a basis, apply these as considerations as they attempt to assist learners in the process of knowledge expansion and construction. They should be aware, however, that actual learning paths might divert from the direction they had anticipated or intended. Possible barriers to comprehension, too, should be anticipated.

*Knowledge* programmes are by no means an easy undertaking. These programmes seek to support the process of learner's construction of meaning about the world without being able to communicate directly with the learners. Consequently, productions based upon a constructivist understanding of children's learning processes will provide the child viewers with sufficient space to steer their

own course. The fact that this strategy can be fruitful is born out by a large number of successful formats children and young people have consciously selected as their learning environments. ■

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## THE AUTHOR

Angelika Speck-Hamdan, Dr. phil., has been a Professor for Primary School Pedagogy and Didactics at the University of Munich since 1995.