Abstract:

This paper outlines three prototypical modes of teaching and learning and their consequences for the design of eLearning environments. I distinguish between transfer of knowledge (mode I), acquisition of knowledge (mode II) and construction of knowledge (mode III). Based on this theoretical framework I will develop the notion of “educational scenarios” and integrate this concept into a three level perspective: scenarios – interactions patterns – usage of tools.

1 Three prototypical models of education

1.1 To transfer knowledge (Teaching I)

In this model the origin of students’ knowledge is based on knowledge possessed by the teacher. Teachers know what students need to learn and it is the teachers’ responsibility to transfer this knowledge into the student’s mind as easily as possible. The transferred knowledge is abstracted knowledge prepared in a special way (the so-called didactical preparation), so that students are able to capture the content not only fast, but also to memorise it on a long term basis.

There are some links and relations of this model with behaviourism, a now outdated learning theory: The central tenet of behaviourism is that our behaviour is the product of our conditioning. So it claims that not our mental processes determine what we do. Learning is therefore a conditioned reflex which takes place through adaptation, a process in which the student’s behaviour (reaction) simply results from an appropriate stimulus. Searching for appropriate stimuli cause the main theoretical and educational problems according to this theory. These stimuli have to be supported by adequate feedback to emphasise the correct (=desired by the teacher) mode of behaviour.

Behaviourism is showing no interest to the specific processes of the brain and considers the brain as a black box, which reacts to an input in deterministic ways. This model presents the brain as a passive container that needs to be filled. Behaviourism mainly focuses on steering behaviour and not on cognitive steering processes. And indeed: In occasions where we want to train some basic skills this model is very successful. The language lab based on drill and practice presents a typical example. A further example of such “brainless” training refers to finger exercises for typing skills.

Although the simple stimulus-reaction-scheme has its merits it is already abandoned with respect to mental procedures. Nonetheless the image of a brain as a passive container to be filled is still very popular and in fact it is doing well in situations where learners are “newbies” to a certain domain and need some basic factual knowledge for their orientation. All in
all this mode of teaching has legitimate usage when it comes to low level, static knowledge. We will call the teaching strategy of transferring knowledge as “Teaching I”. For the further elaboration of our main argument it is important to note that the organisational structure of the transfer arrangement is unidirectional. Knowledge goes from the teacher to the student; the teacher “gives”, the student has to “take in”, to absorb, to assimilate. Whenever a reaction of the student is required it functions as feedback to see if the knowledge transfer has worked successfully and produced the “correct” behaviour. From a systemic point of view we have two clearly defined systems where one system (the teacher) dominates and controls the other system (the learner).

1.2 To acquire, compile, gather knowledge (Teaching II)

This teaching model assumes that learning is an active process, which has to be planned, revised and reflected by the learner. The learner itself is an active entity and it is his/her activity, which supports or even is a necessary condition for the learning process. To understand the differences between Teaching I and Teaching II better we have to refine our arguments. Even the simplest form of knowledge transfer (Teaching I) needs some activities by the learner (e.g. attention, listening etc.). The very dumb mode of learning by heart requires already a lot of engagement by the learner (e.g. rehearsal of the material to memorise). So even in the teaching model of transferring knowledge nobody will claim that the learner is not a human being in some kind actively involved in learning. The differences are on a more subtle level: In Teaching I the teacher is not interested to control or even observe the actual learning activities undertaken by the learner. What counts are just the results whereas in Teaching II the whole learning process with all its intermediate steps, its difficulties and provisional results are under surveillance by the teacher. In Teaching I learners essentially get the feedback wrong or true whereas in Teaching II teachers try to help to overcome wrong assumptions, wrong learning attitudes and to assist in the reflection process in order to aid the student to build up a consistent mental model of the subject domain.

Teaching II has kinship to cognitivism. The modern and today very likely dominant paradigm of cognitivism emphasizes in contrast to behaviourism an inner processes of the brain seeking to differentiate, investigate and bring these processes into mutual relation. Cognitivism seeks to develop a theoretical model for the processing operations between input and output of the brain, which in this case is not regarded as a black box. In contrast to the behaviouristic approach the brain is not merely regarded as a passive container, but as a “device” with its own processing and information capacity.

With respect to learning the basic paradigm of cognitivism consists of problem solving. In Teaching II the teacher provides (and controls) a learning environment where learners are able to withdraw, to collect, to gather, to compile etc. the necessary information to solve the presented problem or task. The learner has with certain required actions actively to acquire the necessary knowledge, the teacher observes the knowledge acquisition and tries to facilitate this learning process. In Teaching II the teacher is a tutor, a facilitator who watches and examines not only the product, but also the process.

Under these premises the teacher designs a specific learning environment and includes some “observation points” in order to be able to give feedback during the learning process. As there is no chance to look into the heads of learners teachers have to provide a communication structure. In contrast to Teaching I this communication is based on a dual way channel. Feedback is not only used to judge (wrong or right), but to provide means to help to find the correct solution.

Even if the communication goes into both directions this does not necessarily mean that teachers and learners are on equal terms. In Teaching II the teacher is a kind of moderator or
panel chairman, who directs the discussion. But in contrast to Teaching I it is a real dis-

cussion, the moderator (teacher) considers carefully what the student has to say and as a result
changes his/her attitude accordingly.

Please keep in mind that our description of the different teaching model is conceptual. So the
apparently differences between these two models could be very small. Concerning Teaching I
it could even happen that there are tasks and problems presented, but just presented. There are
no built in observation points to facilitate the learning process. On the other hand in modern
curricula nowadays we have permanent test situations meaning that a complex learning pro-
cess is divided into many small learning products. In our understanding these “observation
points” are test situations to judge the learning product. They give learners hints if they are on
the right or wrong track, but these check points do not serve as an individual help provided by
the teacher. They are just interim judgements. Even if teacher do react (for instance if many
students have failed) by providing (e.g. presenting) additional information their teaching
mode remains in the boundaries of model Teaching I.

There is a central difference to check points in Teaching I compared to Teaching II. Obser-

dation points serve in the first model to improve the transfer of knowledge (more precise, more

concise, more effective etc.) to the audience, whereas in the second model the individual

learner is supported to progress. To get the required status information from the learner a spe-
cial learning mood has to be generated. Learners must trust teachers that they do not exploit
their bad performance to their disadvantage.

\[1.3 \quad \textbf{To develop, to invent, to construct knowledge (Teaching III)}\]

In the model of Teaching II all problems and tasks are presented by teachers. This has various
consequences:

- Only the teacher practices the art of inventing and presenting problems. The stu-
dent is taught to solve problems but not to “invent” and present them.
- For pedagogical reasons the problems chosen have only one clearly defined solu-
tion.
- For didactical reasons the problems are clearly cut and cleaned up so that the task
at hand is evident and the solution is straight forward so that the problem can be
solved in the limited time the curriculum guarantees.

In real life advanced knowledge especially professional knowledge [1,2] is irreducible com-
plex, uncertain, instable, unique and governed by value conflicts, which are not solved by
reason but by power. Without going into details [3] the characteristics of professional
knowledge mentioned above assumes that we live in an inherently turbulent environment with
indeterminate problematic situations, which “are not in the book”.

This supposition generates a paradox: How can we teach problems nobody ever has confront-
ed let alone solved? How can teachers teach so that students become better teachers than the
ones they learned from?

In a wonderful short science fiction story Isaac Asimov [4] reflects on this apparent paradox-
cal situation: Children brought up in a futuristic society have to undergo a special test where it
is determined which profession they are going to practice. All the knowledge of former ge-
nations is transferred directly in their brains by a special tape during the so-called Reading
Day. Only the protagonist of the story is not treated by tapes but moved to a secret but won-
derful and lazy environment where he is supposed to go around, to read, to talk to other pe-

rsons who weren’t treated by the tape either. Shame and pain characterized the feeling of the
protagonist who was seemingly treated so different from all his friends and who was not edu-
cated (“tapped”) for a special profession. What surprise as he learned that his apparently non-
education was a special education for a special profession: He was supposed to become a tape
builder, a profession responsible for new knowledge programmed into the tapes to guarantee
the advancement of this futuristic society.
Sure, this analogy must not be taken literally: If we want to teach students to step onto the
shoulders of teachers, to invent new things and to produce and generate new knowledge we
have to provide a special learning environment. In this respect the analogy still holds. But
instead of a lazy environment it has to be a challenging environment, which is sufficiently
complex, uncertain, instable and unique so that old traditional knowledge or solutions do not
work anymore.
In a certain way this teaching model is not any more a teaching model at all. There is no com-
plete control of the learning situations by the teacher anymore. Teachers and learners alike
have to immerse into a situation where the outcome is not predetermined. They both have to
master situations at hand and the differences between teachers and learners maybe are only
more experiences and more meta knowledge on how to reflect on complex situations (e.g.
how to design local experiments) on the teacher’s side.
Teaching III has strong links to constructivism. Constructivism refuses a so-called “objective”
description (representation) or explanation of reality. Reality is considered as an interactive
conception where observer and observation object are mutually and structurally linked. Even
pure observation itself is a kind of activity, which influences the observed thing. In this aspect
reality is observer relative as we can see not only in social science (e.g. to observe a human
changes its behaviour) but also in physical science (e.g. relativity and quantum theory).
In order to avoid misunderstandings it is important to see that constructivism does not neglect
the external world, does not support the philosophical theory of solipsism. Constructivism
only says that there is no reality “out there” which can be perceived without a subject, the
human mind. There is no “objective” god’s eye, independent from a perceiving human mind.
Neurophysiological studies show that our sensory organs do not just transfer the inputs form
the outer world to our mind, but already come up with structures and interpretations during
the processing stages. We see not colours and shapes but gestalt.
From a constructivist point of view learning is considered as an active process in which people
construct their knowledge by relating it to their previous experiences in complex and real
situations in life. In their practical lives people are confronted with unique, unpredictable sit-
uations the problems of which are not yet obvious. Therefore, in contrast to cognitivism, the
solving of already existing problems is not the main priority, but the independent generating
of the problem. These must be searched for in confusing, insecure, unpredictable and partly
chaotic situations.
As in Teaching II where teachers try to help individual learners in their learning process there
is a individual component in Teaching III as well. Students are constructing their knowledge
by relating it to their previous experiences and lives. In that respect it is by no means Objective
Knowledge in the Popperian sense [5] but Personal Knowledge as Michael Polanyi has
coined it [6].
Teaching III requires a special two-way communication structure very different as in Teach-
ing II. In Teaching I the communication is preset and controlled by the teacher whereas in
Teaching II and III the communication is on equal terms. But there is a crucial difference in
Teaching II and III: While the communication in Teaching II is predominantly verbally in
Teaching III most of the time there is no linguistic representation. The teacher shows the stu-
dent how to do it! Either the taught thing is too complex, too multifaceted to express it in the
serial structured language or the action process itself has inner qualities (body feelings, holis-
tic indivisible characteristics), which prevent an adequate verbal representation.
There are many thinkers and philosophers who have worked out the limitation of the linguis-
tic representation [7,8,9]. One example may illustrate their line of reasoning: The famous
dancer Isadora Duncan was asked after one of her performances what the dance did mean. She answered: “If I could tell you what it meant, there would be no point in dancing it.” [7, p137 and 464]. Whenever we can’t express the meaning verbally we have to show it in real actions. The teacher has to show what s/he means and has to develop a special language, which is able to represent some aspects of the unspeakable. Language in this meaning does not necessarily mean linguistic expressions, it could be also e.g. the notation system of music, the notation system of check players, the graphic representation of buildings of architects, the so-called “body language” etc.

In Teaching II both teacher and learner are not only mentally but also bodily structurally coupled e.g. they function as intertwined systems. They learn from each other at the same time as they teach each other. The teacher can fail in mastering the situation and has his or her authority only by virtue of the greater experience and the trust the learner has to the teacher’s guidance. The teacher takes the role of a “coach” or panel member in a discussion and thus loses his seemingly infallibility. A football trainer, for example, may not always successfully kick goals, or even be one of the best players of the team. Accordingly a teacher is confronted with the criticism of the reality, of practical situations. Teachers make use of their teaching functions by their experience and capabilities of assisting others dealing with complex situations.

1.4 Summary and applications

The following graphic summarises and compares the three different prototypes of education. As one can see these three different types of teaching modes are neutral concerning the subject domain. Each teaching model can be used for humanities like sociology but also for technical sciences like electrical engineering. Clearly enough the problems are in each domain different and maybe their construction presents different levels of difficulty for the teacher. So it may be for instance not easily realisable (or even feasible) to construct a social laboratory where clear cut social problems are to be solved (Teaching II). The humanity type of domains tends to be complex, uncertain, unstable e.g. it is easier to construct situations for the model of Teaching III. But it is realistic to imagine a social situation where we design some isolated communication problems and present them – for instance in a (theatre) play like situation – to students. On the other hand it is sometimes dangerous to immerse students in real situations where they have to master technical problems. But think of the flight simulator as a prototypical model how media can be used to provide the required teaching model.

On the other hand all teaching models are also neutral against the media they use. So we can imagine computer software for all three models ranging from programmed instruction (Teaching I) to problem solving software (Teaching II) to complex simulations and/or so-called micro worlds (Teaching III). It is said that the inherent nature of the Internet brings the real world into the classrooms and with the chaotic hyperlink structure it clearly advocates model Teaching III. But note: The Internet can also be used for Teaching I (transmitting PDF-Files or presenting web pages without hyperlinks or a narrow set of predefined sets of hyperlinks). Also keep in mind, that so-called interactive software not necessarily belongs to Teaching II or III. The crucial point is not interactivity itself (e.g. the interaction with the software), but if the interaction is watched either by the human teacher or the programme to give feedback to the student to improve his or her performance.
2 References:


Fig. 1: Teaching modes