

## Holistic evaluations of learning materials

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‘What works’, ‘how does it work’, ‘and under which circumstances’? These questions are not only crucial from a researcher’s point of view, but equally important politically. One problem is that researchers and politicians often have different conceptions when they talk about effects and the question of ‘what works’. This also becomes clear when questions of effects are addressed in relation to learning materials and designs for learning.

In rough terms, politicians tend toward technological solutions and a deterministic point of view. As a consequence of their political agency, they want a guarantee for a specific outcome. We acknowledge this need for specific effects in a political tendency to monitor the act of teaching and to guarantee a certain outcome of learning processes through the use of a range of technologies. Often textbooks are envisaged as a kind of teacher-proof materials, while the systematic design for learning coded into the material is seen as a guarantee of a certain outcome compatible with the actual curriculum. In line with these thoughts, it is not surprising that from time to time politicians regard the certifying of materials as a political instrument, a means to reach the goal of the national curriculum. For instance, there is an ongoing debate in Denmark on whether the development of new learning materials can be left to chance and the interests of publishers. Some politicians suggest establishing a certifying unit with the task of evaluating and certifying learning materials on the basis of the latest research on “what works”.

Within the field of research on learning materials there is a widespread skepticism towards the political debate and question of effects and “what works”. Effect varies according to context, and the use of learning materials appears to be co-determined by several factors and variables. As a consequence, relativistic counter-arguments can be raised against technological determinism and the political vision on “evidence” and knowledge of “what works”.

In this paper, we wish to accommodate the demand for evaluation, underlining that we share the skeptical attitude towards the conception of teacher-proof learning materials. Teacher-proof learning materials simply do not exist. Empirical research has repeatedly indicated that the uses of learning materials are co-determined by situation and context (Henderson 2008). Drill programs and behavioristic materials with multiple-choice tests exist, and by using them it is possible to learn a specific content without any teacher intervention, but the situational context will make a difference anyway, and students will benefit differently from it. Furthermore, the scope of such de-contextualized learning materials is limited. In an educational context, however, learning materials are used as tools to promote education, and in this setting the use and the outcome of the use is co-determined by the teacher and the situated interaction among the students.

Thus, the notion of teacher-proof learning materials is a regulative idea in the political discourse, rather than a type of real materials. This does not mean that we should give

up the idea of investigating the effects of learning materials. Quite the contrary: we find it necessary to widen the scope of our investigation to incorporate co-determinative factors, and to develop a holistic framework for evaluating learning materials and designs for learning. It is not enough to ask “what works”. We have to add qualitative and contextual questions, namely “how does it work?”, “under which circumstances?”, and “which competences can students expect to develop by working with this material?”

We and our colleagues have been participating in the development of a number of learning materials based on empirical research and theoretically generated design principles, and on the basis of both empirical data and theoretical principle we have argued for the success of some learning materials and the shortcomings of others. But we have felt a still stronger need for a firmer basis for these claims and a still more urgent call for a thorough framework on the basis of which comparisons between learning materials can be made. The ultimate, yet unattainable, goal is to develop a yardstick to measure which one of two learning materials is the best.

The aim of this paper is to present a holistic framework for evaluating learning materials and designs for learning. The point of departure is a short review of some related literature and our basic definitions clarifying the objects of the evaluations.

As will appear from the following, we use two connected but separate concepts: *learning materials* and *design for learning*. We understand a learning material as an artifact, e.g. a textbook, a blackboard, a computer, while we define a design for learning thus:

*Definition: A design for learning is a constellation of artifacts (which can be called learning materials) arranged (in space) and articulated (in time) by someone with the intention to initiate and support someone's learning.*

This entails that a design for learning can comprise several learning materials, and a learning material can “prescribe” or implicitly presuppose a design for learning.

A prototypical learning material can for example be produced by a group of authors and published by a publisher as a text book, an ICT learning object etc., while a design for learning can be the product of a teacher's explicit or implicit plans for the layout of the room with the texts and objects it contains. Learning material includes more or less explicit descriptions or expectations inherent in the design of the learning situation. An ordinary text book implicitly presupposes that the teacher will teach from a desk at the front of the room whilst the students will sit in rows and listen, and carry out the assigned tasks. An educational computer game presupposes that the students will sit in front of their computers and play, a storyline framework presupposes that teachers and students will collaborate in many places and through a variety of interactions, etc.

On the basis of these definitions we present the framework as a three-step method for performing a holistic evaluation.

*Definition: A holistic evaluation of learning material comprises investigations of*

- ***the potential learning potential***, i.e. *the affordances and challenges of the learning material, and the competences supposedly supported when working with the material*
- ***the actualized learning potential***, i.e. *the potential for learning when the design for learning is enacted by integrating the learning material in a situation in a given context, and*
- ***the actual learning***, i.e. *how the participants actually develop their competences through working with a learning material or enacting a design for learning.*

The first part of an evaluation consists of analysis and interpretation of the learning material as a text. This analysis leads to the description of the potential learning potential.

When introducing learning materials into a concrete situation, some parts of the potential of the learning material are actualized through integration with the historical constellation of artifacts in the situation. The students and teachers more or less deliberately choose to supplement the learning material with tools and materials, and these phenomena comprise the design for learning which constitutes the actual learning potential.

When the teachers and students have worked with the learning material and have thereby enacted the design for learning for a period of time, they are expected to have learned something. The producers of the learning material might have articulated the *expected outcome*, and the analysis of the potential and actual learning potentials may point to a further range of *potential outcomes*. The actual learning outcome can be measured against these two forecasts.

In all probability, no single evaluation of a learning material can comprise all aspects of this complex framework. However, the framework can be used as a *heuristic* to evaluate and discuss the shortcomings and benefits of evaluations of learning material, and as a *tool for planning* an evaluation of a design for learning.

The triple division can be understood as a temporal structure: before, in, and after use. However, it is also important to understand it as a methodological structure. Each of the three points can be regarded as a perspective on the evaluation of learning materials, with each perspective characterized by its own logic and accessibility, because the three temporal phases correspond to three different types of participation and relation to the teaching situation.

## **Related literature**

In this section we will give a short overview of selected literature, showing how related literature can most often be categorized under one of the three steps presented above.

### **Before use – Evaluating learning material as text**

A number of studies and frameworks focus on an analysis strategy in which the learning material or course is evaluated as a text: that is, the object of study is the explicit and implicit descriptions of student behavior and expected learning outcome. Baker (2003) has developed a framework for the design and evaluation of Internet-based distance learning courses on the basis of Ralph Tyler's (1949) theory of curriculum development, Bloom's (1956) learning taxonomy and Blanchard's (1981) SMART framework. This framework is designed for the evaluation of distance learning courses.

Leacock and Nesbit have developed a very popular and cogently presented framework called Learning Object Review Instrument (LORI). LORI enables evaluators to create reviews consisting of ratings of and comments on nine dimensions of quality: content quality, learning-goal alignment, feedback and adaptation, motivation, presentation design, interaction usability, accessibility, reusability, and standards compliance. A primary goal of LORI is to balance assessment validity with efficiency of the evaluation process (Leacock & Nesbit, 2007); evaluation is thus not based on close reading or detailed analysis, but on the evaluator's overall impression of the learning object's dimensions of quality.

### **Before use – teachers' evaluation of learning materials**

In the Mod4L project (Falconer, Beetham, Oliver, Lockyer & Littlejohn, 2007) the goal was to investigate teachers' choice of concrete learning design, and to develop a framework for evaluating learning designs from that perspective. The framework consists of four stages of sharing and reuse of learning designs (Falconer et al., 2007, p. 19), and of eight principles related to the descriptions of learning designs and the underlying pedagogies that influence practitioners' choice of learning designs (Falconer et al., 2007, p. 68).

### **In use and after use – Evaluating learning material in concrete situations and by testing learning outcome**

Another group of studies and frameworks makes use of ethnographic research to investigate the use of learning materials in concrete situations, and in some cases includes test-based evaluation of the participants' learning outcome.

Harley, Seals & Rossen (1998) apply a problem-based approach to study a learning tool to support object-oriented design of computer programs, using video to capture the students' collaboration and screen-capture to record their interactions with the computer. The analyses focused on the quality of the learning material through analyses of students' interaction with the system and the resulting problem-solving success.

The research group centered around Neil Mercer and Rupert Wegerif has developed a number of innovative computer programs based on the hypothesis that students improve their thinking skills by developing a few ground rules of dialog. This group

has carried out a number of evaluation studies to support their hypothesis, including discourse analysis of transcripts based on video recordings of students' collaboration, pre- and post-intervention reasoning tests etc. (Wegerif, 2004; Mercer & Wegerif, 2001).

In Krauss & Ally (2005), the outcome of integrating evaluation of learning objects in the design process is studied through a variety of methods, from student and faculty rating and survey questionnaires to think-aloud sessions.

The literature reviewed here, and all the other literature we have knowledge of in this area, focuses on some aspects of the design of learning: its intentions, its use, the learning outcome etc., but none provides a holistic view of evaluating learning materials. It is therefore our intention to present such a holistic perspective.

## Some basic definitions

The object for evaluation seems quite distinct and obvious, at least in the case of learning materials. But what are learning materials? At first glance they appear so solid and observable, as objects which can be investigated, with distinct features to describe. But in fact the notion of learning materials is a fluid concept used to denote different types of materials and resources in relation to teaching situations: textbooks, on-line learning materials, educational games, mobile phones, blackboards, digital boards, charts and literature among others. For the purposes of our study, we define learning materials by dividing them into three types:

*Definition: Types of learning materials*

- g) **Functional learning materials (tools)**, characterized by their facilitation of learning and teaching: board, computer programs, projectors, mobile phones etc.
- h) **Semantic learning materials (texts)**, characterized by their meaning constituted by signs and semantic references: film, literature, charts, pictures, paintings and other texts and objects with references to specific domains of experience.
- i) **Didacticized learning materials**, characterized by combining tools and texts, and facilitating learning and teaching: textbooks, on-line teaching materials, educational games etc.

The word *didacticized* is a neologism created from the word 'didactic', which in its Germanic form (*Didaktik*) signifies planning and reflecting on teaching. Thus something which is *didacticized* is the result of the process of anticipating and prescribing the activities that teacher and students (should) perform; that is, a didacticized learning material has a more or less implicit design for learning inscribed in it (Jens Jørgen Hansen 2006).

The first two types have something in common, because they do not have designs for learning coded into the material; they become learning materials through being part of a contextual design for learning which co-determines the use of the learning material

in the situation. These different types of learning material and their integration into designs for learning must be taken into account in order to have an inclusive definition of learning materials. Learning materials are materials and tools integrated into a design for learning: whether a contextual design for learning co-determining the use of the materials, or an immanent design for learning coded into the material, or both.

Thus, as we have already underlined, there is a close relationship between the notions of *learning materials* and *designs for learning*, at least viewed from the material point of view.

In the definition of the concept 'designs for learning' the word 'artifact' was included. We use this concept along the line of the activity theoreticians (Wartofsky 1973; Cole 1996; Säljö 2005; Østerud & Wiig 2000) who define artifacts as both material tools and objects and as ideal "in that their material form has been shaped by their participation in the interactions of which they were previously a part and which they mediate in the present" (Cole 1996: 117). Some artifacts have a material aspect, others are more or less completely ideal - even though ideas or mental models need some kind of external representations (for example spoken words) if they are to be shared with others. In an educational context the external representation is crucial, underpinning the important role of learning materials.

We have elaborated a typology of artifacts adapted from Cole 1996, who adapted it from Wartofsky 1973, whilst emphasizing that there are important differences between our definition and those of Cole and Wartofsky. We differentiate between:

#### *Definition*

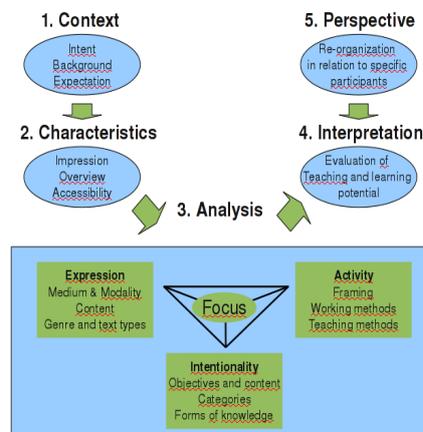
- **primary artifacts:** *perceptual objects we can point to, such as a) physical objects, tools and technologies, b) layout of the physical environment, c) texts, i.e. the physical signs or marks that can be pointed to.*
- **secondary artifacts:** *conceptual objects we can refer to as existing, such as a) rules: laws of nature, laws of the state, moral laws, (computer) algorithms, etc., b) processes: social algorithms: what is to be done first, next, and then in a social context, c) mental and social models: world view, personal relations, authority, ideology; and*
- **tertiary artifacts:** *objects of the imagination which we can refer to as if they were existing, which Wartofsky defines as imagined worlds, like those of art and fiction.*

'Artifact' is a term used for all kinds of objects and processes which are the results of human activity. In our conception artifacts are social phenomena which derive their value and meaning from the situation and social context in which they are used and created. This becomes clear when we analyze the concrete use of learning materials in situations: a) the status of artifacts is constantly negotiated; b) interactions between teachers and students are mediated by artifacts.

## Potential learning potential

There are some consequences and noticeable challenges emerging from our definitions, and hence some challenges for the demarcation of the analytical field which is the object of evaluation of learning materials. First of all we will point out that although desk-based analysis and evaluation of learning materials might result in relevant and important findings, they will suffer from being de-contextualized and distant from the situated use. It is possible to a certain degree to analyze and evaluate learning materials without leaving one's desk, but one must be aware that the analysis is (to be) grounded on a presupposed knowledge of prototypical designs for learning in prototypical situations. It is not enough to analyze and evaluate the learning material on the basis of a "check list" or a formalistic grammar of the well-formed text. We therefore elaborate on Thomas Illum Hansen's functionalistic and phenomenological model for analyzing designs for learning (REF TIL Illum Hansen, 200X). This model describes a number of focal points or perspectives on a learning material, and identifies a series of steps constituting a meticulous textual analysis of a learning material:

*Context* and *characteristics* are the initial descriptive steps towards reflecting on the context for the analysis and describing the first impression of the design, understood as the appearance of an intentional wholeness encompassing both form and content.



**Figure 1:** Textual evaluation of learning materials

*Analysis* is the turning point in the textual evaluation. It has three aspects: analytical, distinguishable, and simultaneously indispensable, with the status of structural parts of a gestalt. We outline this phase further below.

*Interpretation* and *practice perspective* are the final interpretative steps towards a textual evaluation, first articulating the "potential learning potential".

Each step in this model requires further explanation and elaboration. In this context we focus on the analytical triangle. The most tangible and comprehensible way to describe this triangle is with reference to the speech act. The simplest description of a speech act is triangular, emphasizing the communicative origin of the analytical triangle: a) someone is saying something, b) about something, c) in order to have someone doing something. All learning materials and designs for learning can be seen and analyzed as speech acts (cf. Austin, 1962), containing a perceptual representation (the expression: in Austin's words the locutionary act) signifying a thematic field of attention (the intention: in Austin's words the illocutionary act) and appealing to an addressee, framing some kind of enactment (the activity: in Austin's words the perlocutionary act).

Even in traditional teaching, where the teacher lectures and the students sit in rows, there is an act and a framing of a certain activity, because the students are supposed to sit still, listen and understand the theme of the lesson in a certain way. Thus the teacher's speech contains an implicit speech act: "I want you to sit still, listen very carefully, see this before your eyes and understand it in a certain way, specified by virtue of my framing". This triangle becomes explicit when the participants experience problems with the communication and teacher or students have to focus on one of the three aspects; for example: *expression*, when the forms of representation (medium, modes, genres and text types) must be modified in order to achieve an adequate presentation, *intentionality*, when there is a need for reorganizing the intentional structure in order to link the aim and content to the students' life world, and finally *activity* when the teacher finds it necessary to make an appeal to the students or request a certain action. Similarly, the triangular structure often becomes explicit and observable when designs for learning are coded into a learning material.

We use the analytical triangle as a frame of reference when analyzing the learning materials. Our focal points can be divided into four categories, one for each type of participant, and one for the situational context:

- Students' perspective: accessibility, differentiation, progression, and organization of teaching.
- Teacher's perspective: facilitation (while planning, implementing and evaluating teaching), and integrity (concerning immanent coherence within the material itself and transcendent coherence in relation to the norms and values of the teacher).
- Situational perspective: organization (of interactions, space and time, room requirements, organization of furniture, consecutive time needed etc.), and relations (between participants, and to the outside world).
- Society's perspective: integrity (concerning transcendent coherence in relation to the norms and values of the actual school culture), and legitimacy (measured with governmental policy, national curriculum and up-to-date knowledge as yardstick).

It is possible to argue that these focal points are core elements in teaching situations, with their basis in general theories of learning and education. In this connection we restrict ourselves to arguing for the relevance with reference to the logic of the teaching situation: a) the students are supposed to learn something and develop

relevant competences within the horizon of a democratic society, b) the teacher is supposed to carry through the planning, implementation and evaluation of teaching, c) the participants are rooted in a situation in time and space (and thereby confined by the material basis), and co-determined by the relations between participants and their historically developed local culture; and d) the realization of learning and teaching aims is supposed to be legitimated with reference to the surrounding world. These shifts in focalization from the students' to society's perspective imply an epistemological and methodological shift from cognitive and sociosemiotic to sociological approaches to the teaching situation.

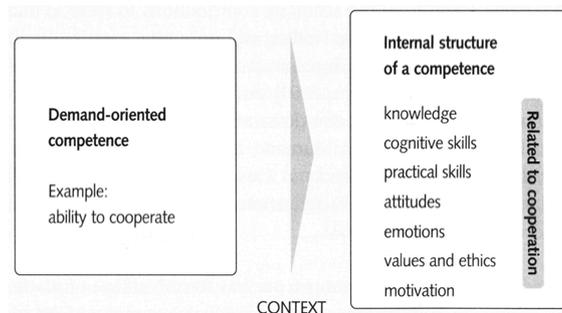
We use the analytical triangulation of expression, intentionality and activity as a pragmatic tool to ensure an adequate frame for analyzing the focal points and mapping the learning potential, stressing that there is no direct access to learning and the content of teaching, whereas all processes of learning have expression, i.e. appearance of forms and representations, as their points of departure.

### **Competences**

The potential learning potential can be described in terms of the competences which the students can be expected to develop, and which can be described from two perspectives. Firstly, competences are closely related to the situation in which they are developed and used, and can thus be described as competences of the community of practice (Wenger 1998) in which the students participate. Thus students first learn to act as students in the ways that the institution, design for learning and other people structure their participation. If students are expected and forced to sit in silence and listen, that is what they learn - though they might of course also learn something through what they hear and see. If, on the other hand, students participate in a more elaborate practice, for example as journalists on a newspaper, they can be expected to learn to act, think and feel like journalists (Shaffer 2006; Bundsgaard 2009).

From a community of practice perspective, competences can be seen as knowledge of and capacity for the practices, attitudes and approaches of a given practice. The potential learning potential can thus be outlined on the basis of a description of the practices in which students will participate while enacting the design for learning co-determined by the learning material under scrutiny.

Secondly, competences can be described on a more generalized level (cf. Rychen & Salganik 2003; Bundsgaard 2006) as the cognitive and practical skills, the knowledge, attitude, and motivation which students develop while using the learning material, cf. Figure 2.



**Figure 2:** Demand-oriented competence definition (Rychen & Salganik 2003).

This perspective defines competence as the capacity to rise to the challenges of a situation; in that way it is comparable to the first perspective, but will have more focus on transferability between practices, and will seek to describe competences in a cross-situational wording. For example, when students collaborate on the production of a newspaper the perspective will focus on the students' development of productive communicative competences, and describe these under such headings as attention to the addressee, knowledge of the typical characteristics of the genre and ability to conform or consciously deviate from it.

To estimate the potential learning potential, it is necessary to have a thorough understanding of the prototypical design for learning implied by the learning material, and thus to analyze the design in all its complexity. This part of the evaluation is a textual analysis and an analysis of the implicit or explicit description of the teaching and learning situation.

The next step in a holistic evaluation of learning materials is research into the actual use in practice. Such investigation can lead to an identification of the actualized learning potential.

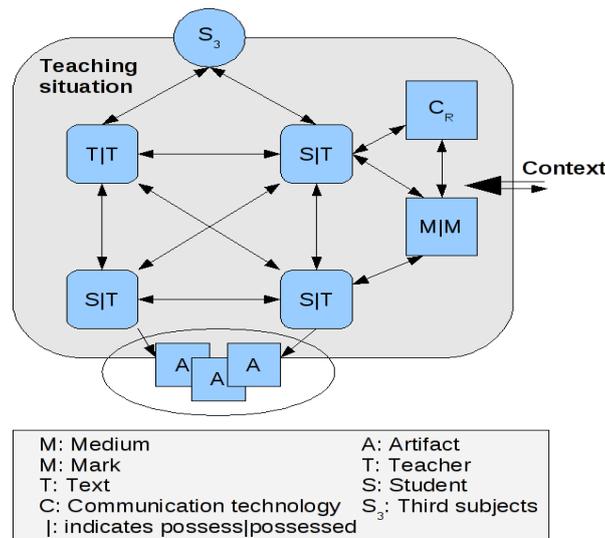
### **Actualized learning potential**

The actualized learning potential of a learning material is a function of several factors in the situation where the learning material is used; thus a design for learning unfolds some potentials of the learning material in the situation and prevents others from unfolding. Other important factors co-determining the actual learning potentials are 1) what could be termed the 'Zone of Proximal Development' of the participants (students and teachers), and 2) the organization of the situation (participants, space and time, history, context, and cultures). *Thus: What is observed in a concrete situation is not solely due to the learning material.*

To further develop the understanding of how a learning material functions together with other factors in the situation, we present a Situation Model describing the crucial factors and their interrelations.

One of the most common conceptual models of the teaching situation is the so-called learning triangle, which depicts three important aspects of a teaching and learning situation, namely the teacher (T), the student (S) and the content (C) being taught. But the learning triangle has a number of shortcomings, especially if it is the mental model of the participants or the producers of the learning materials. It conceals some of the most important traits of the teaching and learning situation: for instance, that there is more than one student, that artifacts are dealt with by participants who are related in complex power relations, and that the interaction is situated in a context. These shortcomings are addressed in the model of the teaching and learning situation below (cf. Bundsgaard 2005; Bang & Døør 2007).

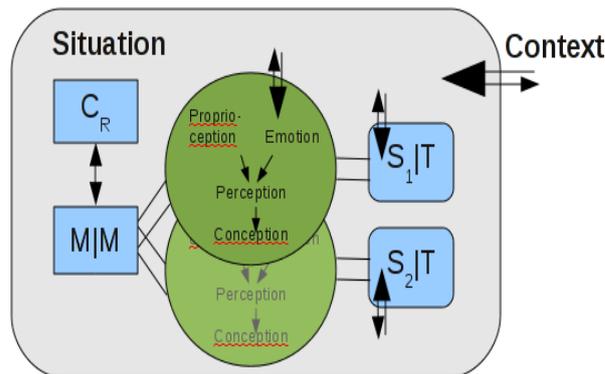
A teaching and learning situation is a communication situation, i.e. it is made up of persons or groups of persons communicating by means of communication technologies (C) to position and consume marks (M) in media (M) as texts (T). There are always at least three subjects participating in a communication situation:  $S_1$  and  $S_2$ , who produce and consume the marks in the media, and  $S_3$ , those who participate in setting the stage, existing in person or in the minds of  $S_1$  and  $S_2$  or experiencing the consequences of the interaction between  $S_1$  and  $S_2$ .  $S_3$ , and who can be positioned as the ones influenced by or influencing the situation. Because we are addressing questions regarding teaching, we substitute the general concepts of  $S_1$  and  $S_2$  with the specific roles of teacher (T) and student (S).



**Figure 3:** Teaching situation (Bundsgaard & Illum Hansen 2009)

This model shows how there is more than one student in a teaching situation, and that the students relate to each other as well as to the teacher in distinctive ways. Even when the students are not expected to work together, they will make a difference to each other. Through the “possessed” texts (|T) the model moreover shows how each student and teacher has his or her own individual understanding of the situation and the texts and artifacts involved.

This can be further explained by the model below (Figure 5), representing how texts are consumed by participants in a communication situation. The model shows how each subject (S) processes the perceived marks in media (M|M) through and because of both proprioception (i.e. sensation or experience of oneself in the situation) and emotion (i.e. sensation of the situation as a whole) before conceptualizing the marks as having a certain meaning. The concrete conceptualization is at the same time a function of the situation and the context in which the situation is inscribed.



**Figure 4:** Consuming texts (Bundsgaard & Illum Hansen 2010)

Because all these factors are functions of our personal histories and experiences, no two persons will actualize exactly the same web of meaning when perceiving the same range or constellation of marks. Thus their texts will differ in several ways, which is why the model depicts texts as possessed by the subjects (S|T).

More specifically, in a teaching situation the participants each carry their own understanding of the “meaning” of the manifested texts and other artifacts. A successful learning material therefore supports many different acquisitions of the content, and not least, it allows for the presence of several interpretations and value systems in the situation, leading to different equally well-grounded understandings and texts.

Nothing happens outside of a context. We define the context as the entirety of artifacts, subjects, society and culture related to the situation. In principle, that consists of the whole world, but in a specific situation some part of the context will be more closely related to the situation than other parts.

### Work-flow-processes

The models presented above are situational models representing still images of the situation. But as teaching and learning take place in time, an investigation of the work-flow is needed in order to understand how learning materials prescribe and support these processes.

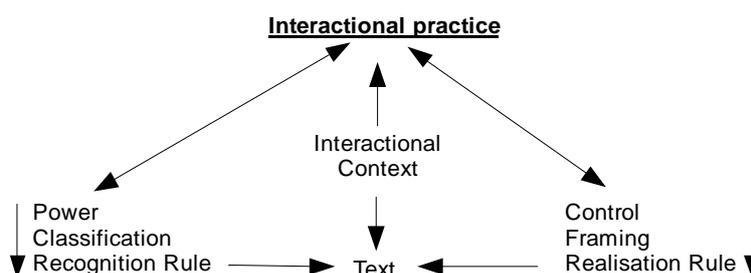
We will present a few models showing how different perspectives lead to different insights.

### Interactional models

Following studies into classroom talk patterns, Sinclair & Coulter described a typical teaching process as consisting of three functions: the teacher initiates the process by asking a question, a student responds, and the teacher evaluates the response. Sinclair and Coulter (1975) briefly describe this as the IRE-structure of teaching. Extending from this line of thought, other organizations of teaching and learning can be described as a number of speech acts. For example, Mercer and Wegerif point out that introducing a single component, namely student discussion of the question before responding, may lead to a completely different process and learning. This type of interactional process model is open to ethnographic observation supported by video recordings, and the function might for example be found through analyzing transcribed passages of student talk and action.

Bernstein's model (Figure 6) of the process of acquisition within a given framing relation (Bernstein 2000: 16) views the interaction from another perspective

Figure 5: Transmission Context (Bernstein 2000: 16)



This model adds a view of the teaching situation as a practice with inherent power relations. It shows how classification of a given context legitimates some things and renders others illegitimate in this context. To be able to recognize what is right and what is wrong in this context, students must understand the *recognition rules*. But in order to be able to perform legitimate communication themselves, they must also acquire the *realization rule*. Bernstein's model shows how these processes of recognition and realization proceed in an interactional context.

### Interaction sequence or work-flow models

On another level, we find interaction sequence or work-flow models showing how teaching and learning are comprised of sequences of interaction, i.e. the participants enact a certain work-flow.

Staffan Selander and his group of researchers are developing and working with such a model, which they call the learning design sequence.

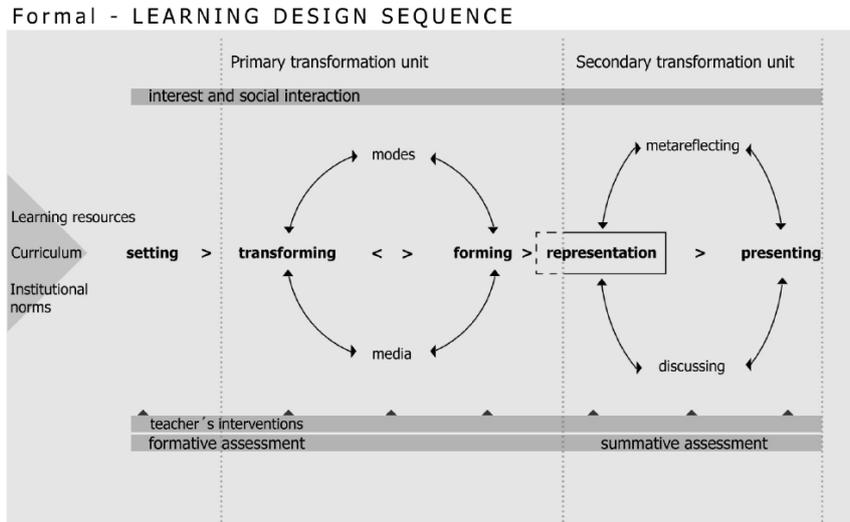


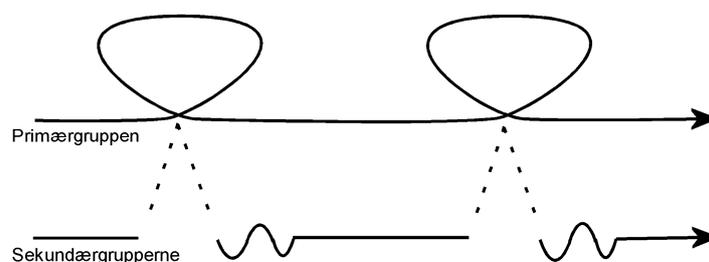
Figure 6: Learning design sequence (Selander 2009: 17).

This model shows how teaching and learning are performed as transformations of content. In the primary transformation unit students *transform* the *modes* and *media* (which we understand to be what we call learning materials) by working with the content in a *social* context, thereby *forming* their understanding. In the secondary transformation unit the students transform their *forming* to a representation, which in itself or through presentation to an audience gives them the opportunity to discuss and meta-reflect over their learning process.

Even though this model is described as a model of “teaching in formal contexts”, we will maintain that it is a model of certain kinds of teaching organizations where the focus is on processing knowledge, e.g. where students alone, in groups or together with the teacher in class investigate a subject, solve a problem or write an assignment. The model does not, at the one end of the scale, describe a teacher giving lectures, nor, at the other end of the scale, does it describe organizations where students collaborate on common tasks, for example simulating an off-school practice or producing art or handicraft products.

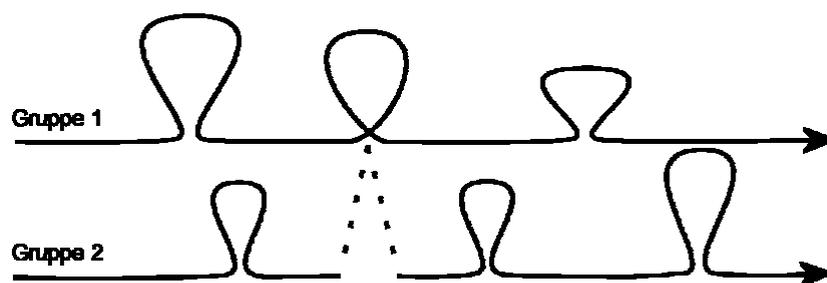
The loop model of Karsten Schnack (2000: 13) and the revised loop model of Bundsgaard (2005: 5.3.3) are further examples of interaction sequence or work-flow models. Schnack's model takes as starting point that when participating in project work students often lack necessary subject or academic knowledge. The teacher must therefore call a temporary halt to the project work in order to lead the students through a so-called “loop”, where they are taught the necessary subject knowledge. Bundsgaard argues that these loops are usually only relevant for some of the students,

and not for others, who might not need this specific knowledge yet, or indeed at all, or who already possess the knowledge or manage to do without it in their project. Bundsgaard edits an extra group into Schnacks model, ending up with Figure 8.



**Figure 7.** Loop model (Schnack 2000: 13; Bundsgaard 2005: 5.3.3)

Bundsgaard proposes a work-flow where students can go into loops exactly when they need to, and maybe even make progress in their process. Bundsgaard illustrates this work-flow in the following way (cf. Figure 9).



**Figure 8:** Learning subject or academic knowledge just-in-time in project-based work (Bundsgaard 2005: 5.3.3)

Bundsgaard argues that this kind of process can be achieved through the use of so-called Interactive Assistants: i.e. computer-based interactive instruction (Bundsgaard 2005:5.3.3).

Other examples of work-flow models describe the different phases or functions performed by students. Project work and simulations of off-school practices are examples of a complex work-flow models. The work-flow of project work could be described as a series of steps or phases: generate an idea, formulate a problem, do research, produce a product, and assess the product and the process. This series would also include discussion and organization of collaboration in cases where students are working in groups.

An example from the other end of the spectrum is a traditional teacher-led work-flow. The teacher gives a lecture, checks the students' understanding (often using IRF-structured interaction), points out which pages in the text book should be studied and which tasks solved, and then the students work on the tasks alone or in peer groups. Finally, the teacher leads a class conference in which individual students present their solutions to the tasks.

It appears that different work-flow models accentuate different aspects of the complex processes in classroom practices. Different work-flows offer different opportunities for the participants in the teaching and learning situation. When participating in a traditional teacher-led work-flow with integrated IRF-structured interaction, students become good at answering questions, but they do not practice discussion, idea generation, problem identification etc. Therefore certain competences are trained and thereby developed in some work-flows and not in others.

Learning materials relate to work-flows in two ways. On the one hand learning materials (more or less implicitly) prescribe work-flows, and on the other, the learning materials support the teacher and students in the implementation of work-flow.

Therefore the work-flow models prescribed in the learning material should be part of the analysis of the potential learning potential. In the investigation of the actualized learning potential, attention must be paid to how far the work-flow follows the intended models, and how it deviates from these models, and models should be proposed which might better describe the actual practice.

The learning materials prescribe and support work-flow, but of course they are not actualized until they are put into practice. The processes are orchestrated in practice by students and teachers who use the resources in the learning material as well as other tools and experience from other processes (including especially, of course, those known from previous educational contexts). When investigating how learning materials support work-flow, focus can be oriented towards the ways in which these re-organizations are possible.

For the participants, some work-flows are well-known and comfortable whilst others might be experienced as boundless and confusing. The adequacy of the prescription and support of work-flows in a given learning material is therefore very context-dependent.

### **Researching into situated designs for learning**

The models above are intended to serve as heuristic models for research in the practices in (and outside of) the classroom. When evaluating the actualized learning potential of a design for learning, one is oriented towards how the constitution of the situation, the contextualization of the learning materials, takes place. The analysis should focus on 1) which part of the potential learning potentials is actualized; 2) does it work in this context, in which ways is the situation a success, what do the students “learn”, how far do the participants feel engagement and motivation for the work, etc?

3) what are the challenges in this context of using these learning materials and thereby enacting a design for learning?

The final goal of these analyses is *to generalize analytically from the specific context to more general claims about the affordances and challenges a learning material will meet in a context of the kind examined.*

The research into situations is oriented towards effects, i.e. what are the effects of changing *these* factors in *this* situation. The research will often make use of anthropological methods, but it can also be more quantitative, with questionnaires answered by the participants, collection of products, artifacts used and created in the work, participants' self evaluations etc.

### **Actual learning**

The last perspective of a holistic evaluation of a design for learning is the analysis of the outcome of working with the design for learning under scrutiny. Outcome can be measured in many ways and be related to many factors. A measurement and estimate of the outcome must take its point of departure in the explicit learning goals and in the potential learning potential which was analytically found in the first phase of the evaluation.

When evaluating the outcome of a given effort, one must have a clear definition of what kind of outcome counts as important. With respect to education, the outcome is learning, which we define very briefly as *change in capacity* (Illeris 2002). More specifically, learning can be defined thus:

*Definition: Learning*

**Learning** is the movement from chaos/conflict/non-capability which takes place in response to combination and change (or the intuitive understanding/capability matures) so that the subject is capable of doing something the subject could not do before (in situations in which it could not be done before).

With capable of, we mean can do (bodily and mentally), can express (communicate), can understand and combine (think), can evaluate (ethics, politics), can perceive (sensitivity), can feel (emotion), and wants to (attitude).

The outcome of education should be learning, but not any kind of learning. Thus one must differentiate between

4. Intended learning
5. Unintended, but valuable learning
6. Unintended and undesirable learning

A design for learning which supports the intended learning goals but at the same time makes the students learn something very undesirable (for example that there is no

point in participating in developing the community for the sake of the common good) might be even worse than a design for learning not supporting the intended learning goals very well.

Thus, even in an “objective” measurement of learning outcome there is a normative aspect.

The methods used for measuring learning outcome are often standardized tests and evaluation of student products, but they can also be based on teacher's estimate and analysis and student's self reporting (using portfolio or learning log, for example).

### **A holistic evaluation framework**

In this paper we have presented a holistic framework for the evaluation of learning materials. Very few actual evaluations will include all three steps, let alone all the aspects of each step. Thus the framework is neither a cook book nor a demand for completeness or exhaustiveness; it is a heuristic to substantiate the design of evaluation and to discuss or evaluate accomplished evaluations.

In order to give an overview of the holistic evaluation framework presented in this paper, we have produced a concept map which includes all the core concepts and shows how they are connected. This concept map can be used as a checklist when preparing an evaluation, and as an instrument to guide a discussion on aspects of a learning material that are encompassed by a given evaluation. The concept map can be found at [www.laeremiddel.dk/holisticevaluation](http://www.laeremiddel.dk/holisticevaluation).

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