Alternative Instructional Models and Knowledge-Organization and Design-Support With CEDID

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Groundwork as well as focus of the following representation is the "Göttinger Katalog Didaktischer Modelle" (Goettingen Catalogue of Instructional Models), the arrangement of which was started by Karl-Heinz Flechsig in the middle of the seventies and which is meanwhile a fundamental field of research for the "Institut für Interkulturelle Didaktik" (Institute for Intercultural Didactic) of the University of Goettingen. This catalogue is concerned with the collection, compilation and systematization of alternative forms of organized learning and teaching and furthermore the documentation and utilization of these by means of publications, courses and computer programs. Since 1989 this is done within the software system CEDID: "Computer-ergänztes Didaktisches Design" (computer-supplemented instructional design).

The use of computers in educational systems is already manifold, but it concentrates on the support of learning processes and general aspects of management (like collection of demographic data, text writing, and time schedules). The growing professionalization of didactical planning which hereby is called "instructional design" urges upon the search for potentials of electronic data processing. Our first steps in this direction dealt with the use data banks, especially for bibliographies; later on we tried out a self-developed program which helped our clients to get a choice among the various instructional models. At last, we decided to develop an integrative software for the whole process of instructional design.

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Theoretical Foundations

A major motive for the continous work on the "Goettingen Catalogue of Instructional Models" was aversion to quick and frequent trend changes in didactical theory and model building that had taken place within the last thirty years, at least in Western Germany, and that had led to a certain "ex-and-hopp-didactic". Conclusively, this work was continued persistently and, beyond a financial support by the "Deutsche Forschungsgemeinschaft" (German Research Foundation), was financed through fees for courses, offered to instructional designers in vocational training.

A further motive was oriented to instructional variety which is grounded in historical, cultural and interindividual diversity: people have developed in different times and under different cultures different patterns of learning and teaching, and to a certain amount these are present as an interindividual variance. Former trials to find out by means of empirical investigations the one and only best fitting instructional method have been given up, at least since a lot of "Apitude (or Trait) Treatment Interactions" have been found at the beginning of the seventies: specific prerequisites of learners and specific requirements of the competencies that shall be evolved urge for specific instructional settings. There exists no instructional "Königsweg" (chief path). If one wants to make use of electronic data processing in a routinized way there must be certain regularities that can be used as a basis for programming the algorithms. The systematization of instructional processes which already had been done within the "Goettingen Catalogue of Instructional Models" offered such regularities.

Furthermore, there is enough insight that the modeling of learning environments must consider the genious components of the envisaged model. If one decides to organize a workshop, the learners cannot be novices of the topics in question; they have to be involved, already during

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the preparation and planning of the workshop, and they have to make certain preparatory decisions which require a rather profound thematic knowledge and experience. Without this, they cannot play their roles as participants with equal rights. On the other hand, if one decides to prepare and start an exploration, the learners may be quite unexperienced with the exploration field, because an exploration usually serves for first contacts with the field and for orientational knowledge about it.

With the help of such a systematization of instructional planning and decisions that had already been done within the Catalogue it became possible and meaningful to develop routines and algorithms for a computer program.

The first try-outs for this were done with existing programs, among these an authoring system. At that time, however, such programs did not support active or even interactive learning in the sense of free constructions by users. This should be an essential characteristic of the planned system as it is expressed with the term "design." Therefore, we decided to develop a program of our own.

Besides this action-oriented concept, the program development was guided by the assurance that people have different styles of learning and operating. The program should be usable under consideration of such different styles. A model that had been developed by Gordon Pask served as a guideline for our work. This model is one among a plainty of approaches to learning styles (Haller, 1992) and makes evident two basic styles of learning (Pask, 1976): "holistic" (with a permanent change between concretion and abstraction) and "serialistic" (a step-by-step learning, where abstractions develop out of concretions).

The construction of programs whithin which learning plays an important role should take account of the experience reported by Pask that serialistic learners hardly can get on well with

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holistic learning environments, whereas holistic learners rather can do so with serialistic environments. "Versatiles" are people who manage best both environments. This leads to the conclusion, that such programs should have at least a "serialistic platform" which is supplemented by "holistic facilities". In our program system (CEDID as well as later on CEWID) this has been taken in regard by using operative knowledge (which regularly is easier structured in a serialistic way), and background-knowledge (which must be asked for and be integrated actively and which usually is more convenient to holistic learners). In addition, this presents a dynamic (operative knowledge) and a static (background or declarative knowledge) component in the system.

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Summary of the Model

With the term "instructional model" a level of medium range for reconstruction and presentation of instruction and learning was steered for in the context of the "Goettingen Catalogue of Instructional Models"; less concrete than the term "instructional method", and less idealized as it is done with different categorical approaches (which are very popular in Germany). The attribute "didaktisch" was chosen in the German expression, because it lays particular emphasis on both aspects: instruction and learning. The noun "design" was chosen in analogy to other programs that support artistic operations (like CAD, Computer-aided Design).

The following list contains the expressions of all 20 models in German and equivalents in English:

- Arbeitsunterricht (activity method, assignment method),
- Disputation (disputation, debate),
- Erkundung (exploration, excursion, field-experience approach),
- Fallmethode (case method),
- Famulatur (apprenticeship, asssistence),
- Fernunterricht (distance study, correspondence instruction)
- Frontalunterricht (classroom teaching, teacher directed learning, expository teaching, frontal teaching),
- Individualisierter Programmierter Unterricht (programed instruction, personalized instruction)
- Individueller Lernplatz (individualized learning center, laboratory plan),
- Kleingruppen-Lerngespräch (small-group discussion, micro-study circle),
- Lernausstellung (educational exhibition, exposition),

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- Lerndialog (educational dialogue),
- Lernkabinett (clarifying educational environment),
- Lernkonferenz (educational conference, symposium),
- Lernnetzwerk (educational network),
- Lernprojekt (project method),
- Simulation (instructional simulation),
- Tutorium (peer tutoring, proctor method),
- Vorlesung (lecture method),
- Werkstattseminar (educational workshop).

Most of these terms are due to historic expressions (the "disputatio" in the medieval university, e.g.). All have a different (about 4 to 8) number of variants (e.g., the "Montessori Method" or the "Jena-Plan" belong to "Arbeitsunterricht",. They are described in a handbook (Flechsig, 1983, 1991; Flechsig & Gronau-Mηller, 1988), in detail by their fundamental didactical principals, the sequential phases, the elements of the learning environment and their suitability for particular contents and target groups. Furthermore, there is a documentation system in a "studio for learning" (Lernstudio) with multiple accesses to the literature (as symbolic representations), audio-visual specimen (als iconic representations) and expressly developed "mini-practices" (as enactive representations). This documentation and presentation system was called the "Göttinger Katalog Didaktischer Modelle" (Goettingen Catalogue of Instructional Models) and soon was supplied with corresponding activities (treatises on and reconstructions of special practices, courses for instructional designers, e.g.).

In 1988 we started with a programmed help (first in dBASE IIIa, then in different versions of CLIPPER) for the selection of instructional models in regard of the given context of a

designer (which models are more or less convenient for my situation?). This was done by ratings on 15 questions concerning the requirements and demands which the designer would find in his situation to be handled through training activities. These questions were a sort of touchstones attended to the following aspects:

- the average preknowledge of the learners,
- the average experiences of the learners with different forms of instruction,
- the capability of the learners for self-directed learning,
- the dispensability of the learners from their place of work,
- the conformity between learning environment and aspirated practice,
- the instructional qualification of available helpers for learning (teaching persons),
- the availability of media and other resources,
- the possibility to subdivide the time of learning in larger sections,
- the limitations through certification demands,
- the amount of orientational knowledge,
- the amount of practical knowlegde,
- the amount of theoretical (explicational) knowledge,
- the adjustment to changed conditions (amount of accomodative learning),
- the anticipation of future conditions (amount of anticipatory learning),
- the development of personality and self-competence for the learners.

For each of the 20 instructional models a profile of standards in regard of these questions was laid down. These standards were defined in form of an ordinal scale (with the options "very high", "rather high", "rather low", "very low"). The program checked the concurrences and differences of the input data for each of the models and yielded a particular recommendation

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whether the model would be highly or less convenient for the given options or could be choosed at least with certain providences.

This was one of the design operations that were promoted by the program. This program was given the name CEDID: "Computer-ergänztes didaktisches Design" (computer-supplemented instructional design,). This is the list of all design operations which were supplemented by CEDID, each containing about 30 items or operational steps:

Context Analysis (inquiring for informations and decisions about the reference system, target groups, resources, demands),

Program Design (inquiring for informations and decisions about concepts and goals of the whole program to which the planned course design was part of),

Model Choice (which is described above),

Course Design (configuration of a knowledge map, analysis of the disciplinary content and collection of competencies),

Block Design (shaping of the learning environment and its elements, of the learning and teaching functions and actions,, the sequences and phases, all this depending upon the model, that was choosed),

Production (hints for the further production of learning materials which is not directly supported by CEDID),

Proving (hints for the try-out of a design),

Evaluation (evaluation of a design, regarding about 70 criteria, filled out by the designer or another person)

Additionally, this program referred to a large number of resources of the Catalogue which were compiled in form of a knowledge base. This was structured by about 500 headwords, for

each of these there was at least a comprehensive definition, other items for such a headword could be larger explanations (like articles in a handbook), various examples (especially descriptions of realizations in practice), standard formats (like schedules, text components, checklists), data bases, and bibliographic references. Text documents were in the ASCII-format (sequential files) and data-bases in a dBASE-format (random files). All in all, this knowledge base amounted to about 4 megabytes of data.

The program supplemented the work of an instructional designer by guiding him or her during the design operations in form of a problem solving algorithm (step-by-step operations); giving him or her a wealth of background-knowledge, which could be from explanatory knowledge to labour-saving tools.

During the design work, the instructional designer was free to copy from the given background-knowledge whatever he or she wanted as part of his or her work, and could alter these documents to his or her needs. All productions were constantly stored in a design-protocol, which could be recorded, processed and printed, and which would serve as the detailed plan for teachers, trainers, or other instructors. A typical design-protocol for a course of about 30 hours active learning time covered about 40 pages of text and contained details about aims, important topics, competencies for the learners, selected instructional model(s), sequences for learning, demands for constructing the learning environment, hints for useful learning materials, fundamental actions and functions of personalities and further hints for implementing and evaluating this plan. The working time for the instructional designers varied much, normally it was about 20 to 30 hours for such a product.

During the try-outs of the system the developers had the idea to take the program as a platform for creating a more variable system that could serve as a sort of "shell" for other

knowledge areas. This new constructed program was given the name CEWID: "Computer-ergänztes Wissens-Design" (computer-supplemented knowledge design). It offered further resources and enabled a more flexible and dynamic proceeding for authors (as organizers of a knowledge-based system) and designers (as users of such a system). The first applications which were initiated within this new system were concerned with learning strategies, task-oriented learning (assignments), library activities, social research methods, and an introduction into the system itself. There are new program functions, for example it is now possible to use and present pictures of the PCX-format and sounds of the VOC-format. Furthermore, there is a log-book function which can register all activities of the user on the PC (by this, one can for example see, which documents are neglected and which are often read and used). It is possible to call any installed external software via the menu or automatically at a given operation.

We then started to transfer the operations and resources of CEDID into the new implementation. By this, CEDID now is not a stand-alone system, but a complete application under CEWID among others which are already set to work or might be done so. The operations for instructional design were organized in a new structure:

Orientation,

Context Analysis (analyzing cultural characteristics, target group, organization, resources, demands, knowledge area, competencies for learners, underlying over-all program),

Selection of one or more instructional model(s)l,

- Block Design,
- Design Evaluation,
- Planning of realization,
- Completion,

- Evaluation.

Evaluation of the Model

CEDID was proved in several workshops with instructional designers from different fields of training and education (vocational schools, industrial firms, service industries, adult and further education, administration, teacher training). A formal evaluation has not been initiated as yet, because the informal evaluation produced enough information and clues to improve the system up to now.

Users of the system often expressed expectations that such as tool should not only give inspirations and documents for the designers, but also should be able to take decisions off their shoulders. The informal evaluation not only gave hints for improvement, but also made clear that instructional design cannot be automated; none the less, it can be supported by such a system, in the case this is used by a rather experienced and reflective person (semi-professional designers, at least). In order to avoid improper use of the system and to prevent false expectations, it will be given to users only after an introduction and training of about two days.

Another experience was, that it could be very helpful to arrange a two-people situation for the instructional designers during their work with the system. This partnership mostly leaded to a profitable division of labour and function: While the one person was managing at the PC (and therefore was close to the program and tended to submit to it), the other person was accompanying this work with a certain distance (and therefore was more free to critical observation and reflection). This comes very close to the opposite dimensions (active experimentation - reflective observation) within the model of learning styles, which had been

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constructed and researched by Kolb (1985), and this might be a useful access door to general research on computer literacy and computer handling.

Future Directions

At the "Institut für Interkulturelle Didaktik" several applications within the CEWID-system have been set to work, beyond the ones that had already been spoken of one for preparation, proceeding and evaluation of bi- or international school partnerships and one for the study of intercultural didactic. It was near at hand to test a utilization by non-professionals, both authoring and designing. This was done by establishing a special version for children and adolescents: Two youngsters (14 and 16 years old) created applications for installing and maintaining an aquarium and on "environment protection at home", which both were quite well-done. They spended a lot of time and energy on graphic components and attached great importance to schemes and pictures.

At present, profound improvement of the whole program is done, moreover as a version under WINDOWS. Besides such aims as a more comfortable program-user interface, the new version will fulfill the following demands : through object-orientated programming and dynamic data linking more availability of documents and other objects, even with different file formats, what makes it easier to use resources and works that are already there; better lay-out resources (fonts, graphic) for more attractive design products; supplementation of further activities or operations (process control, e.g.); at last, more and easier accessible online-help in form of advices to ambitious knowledge organization activities.

Furthermore, there are perspectives for a more exhaustive consideration of different styles of learning and operating within such a software. This will require concomitant research activities on the question how people think and enact under the shelter and challenge of this system. We do not want to leave our position, that a knowledge-based system should supplement the work of an expert and not detach him or her. But if the program could be more adaptable to peculiarities of such a person or a group, that would make a sense. As CEDID, the system for instructional design activities, is already the most progressed application within CEDID, it is near at hand to combine such developmental research on computer handling with research on teacher and instructor planning activities.

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