BASIC SUPPORT FOR EDUCATIONAL STUDY AND RESEARCH - (*BASES*)

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Research in the information society is undergoing radical change. The new challenges make it necessary to rethink research and the ways of educating researchers so that they can cope with them. We show that research has to be considered as skilled practice, consisting of numerous component skills which have to be trained so that future knowledge workers can successfully deal with unstable, uncertain and complex situations. As a practical application of this argument, we outline a project for an integrated Internet service, called BASES - Basic Support for Educational Study and Research.

1. Training researchers

It is not possible and, in fact, not sensible anymore to provide learners with pre-given answers to pre-defined generalized situations. What they rather need are the skills for investigating themselves the complex, new and uncertain situation they have to deal with. This kind of work is what is usually called "research", or, using a modern term, "knowledge work". This demand a radical re-thinking and re-design of teaching and learning, cf. e.g. [15], [16].
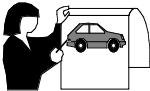
Knowledge workers typically have to "consume" and "digest" information from widely varying, dispersed and uncategorized sources. They are being changed by information and seek to change others by it. Changing context is characteristic of the situations knowledge workers have to deal with. Buckingham Shum ([3] p. 902) calls these situations "wicked problems", as they cannot be solved by known methods and pre-defined procedures. The process of identification and definition (or, as we would say: construction) of the problem is itself the main task at hand, requiring complex judgment and negotiation among the stakeholders. In this process of framing the problem, the goals, constraints and possible solutions change permanently, as does the need for and use made of information.

Research as a professional activity is, in our understanding, not restricted to the research professionals at unviersities and in R&E departments in industry, but rather a basic and essential skill for knowledge workers in the information society. But in our case we decided to specialize on educational research.

3. Research as skilled practice

Research work is neither an art that cannot be taught or learned, nor a set of rules and regulations to follow. It is a skill, or better a set of skills, that can be acquired (at least to a certain degree) and whose acquisition can be supported by training.

The mastery of a skill is not a question of "all-or-none": it is not the case that one day we are unskilled in a field and the next day we are experts. There certainly are steps and phases in the acquisition of skills, i.e. in the emergence of the capacity. Following the model proposed by Dreyfus and Dreyfus [8], who distinguished five steps in the process of passing from novice to expert, Baumgartner/Payr [2] have outlined a three-dimensional heuristic model of teaching and learning with thress different styles of teaching. These different teaching modes modes have important impacts of the adequates types of learning interactions:

Transfer	**Tutor**	**Coach**
· Transfer of propositional knowledge	· Presentation of predetermined problems	· Action in real (complex and social) situations
· to know, to remember	· to do, to practice	· to cope, to master
· Production of correct answers	· Selection of the correct method and its use	· Realization of adequate action strategies
· Verbal knowledge, Memorization,	· Skill, Ability	· Responsibility
· to teach, to explain	· to observe, to help, to demonstrate	· to cooperate, to support
· goal: memorizing the truth	· goal: choosing the right method	· goal: constructing a viable world

The social perspectives and implications of these styles of teaching are substantially different. The knowledge transfer model is based on the belief that there exist people who know the right answer to a pre-defined question (e.g. the teacher). It is heir to a positivist tradition and corresponds to a hierarchical career model with competition at its center. The "situated learning" model, on the contrary, subscribes to the constructivist viewpoint where the coach collaborates with the learner to cope with a complex real situation for which neither of them has a ready solution. At the beginning of their concerted action, learners legitimately participate only peripherally [11]. During the learning process, their responsibility grows continuously until the learners can themselves act as coach for other, new learners.
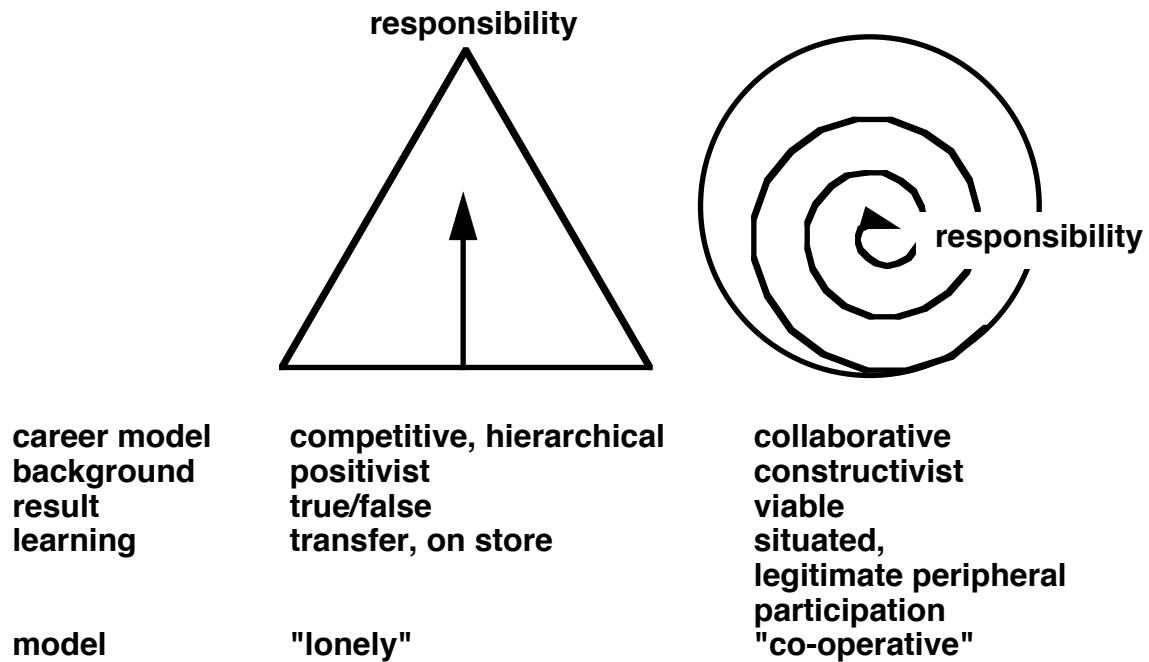
	competitive, hierarchical	collaborative
career model		
background	positivist	constructivist
result	true/false	viable
learning	transfer, on store	situated, legitimate peripheral participation
model	"lonely"	"co-operative"

Fig. 3: Career and learning models

The difference between commonsense knowledge and scientific knowledge is not the quality of knowledge itself. Both types of knowledge are structured experiences that one has to develop, acquire, examine and apply for a viable (successful) action. The quality of knowledge does not depend on the difference in range and object domain [12]. Scientific research develops (or should develop) knowledge in a systematic way and uses a meta-language (second order language) to describe the ongoing procedures and activities [9].

Whatever skill we want to train, we need a second order language which functions as a training language. The lack of a meta-language in scientific thinking is the biggest problem we have to confront in training research skills. The existing meta-language describes mainly the products of research but not the activity, the process itself. In training the knowledge worker, we find ourselves in a position where we can only judge if the product fulfills the scientific standards but not the skills that have to be improved. We are like football trainers who can only comment the outcome of a game, qualifying a won game as "good" and a lost one as "bad", without being able to specify *what* was good or bad, what should be improved and how this could be done. A prerequisite for training research is therefore to develop this meta-language, starting with identifying relevant actions and processes that make up the complex practice of doing research.

4. Training research skills with Internet support – BASES project

The logical consequence of this change for learning in context ("situated learning" [4, 10]) is that the support for training these skills itself should make use of the new media that are able to integrate information, interaction and tools.

We follow this approach with the BASES (BAsic Support for Educational Study and Research) project, an Internet service for supporting and training research skills. It is the hands-on

complement to a book on the subject that we are currently finishing. With BASES we support the training of research skills in three different ways:

a) *Cognitive Apprenticeship* [6]: We provide different kinds and qualities of guided practice:
- general information and resources permanently updated and verified. These include links to libraries, grants; reviewed software tools (freeware or demo versions) for research work (e.g. mind-mapping software, bibliography packages); sample macros, stylesheets, forms etc.
- training modules for research-relevant Internet techniques (e.g. searching for and in online databases, assessing the quality of resources)
- interactive tele-learning modules with "human backing" for general research skills like research design, writing, argumentation, referencing.

b) *Anchored instruction* [5]: Starting with common authentical problem situations, BASES offers a wide range of activities to tackle them:
- FAQ collections
- moderated and guided discussions
- online interconnections among users
- modular tele-learning courses for different authentical problems (how to limit the hits of search engines, how to quote Internet resources, ...)

c) *Cognitive flexibility theory* [17]: Learning to defend different points of view and to take multiple perspectives:
- giving different examples of the same task (e.g. paraphrasing a certain quotation, constructing the same argument on different logical bases ...)
- defending different points of view (e.g. presenting the arguments of an author and of his/her critics, summarizing advantages and disadvantages of a certain procedure, product ...)
- choosing different methods on the same subject (taking a commensense approach and a scientific approach, proposing a pragmatic and a theoretical solution, seeing a problem in short and long term development ...)

We call this integrated site for research support a *service*, not a *server*, because we acknowledge that it can only function optimally with "human backing". Beside the need for constant updating and for dealing with requests, problems, contributions and suggestions, there are different situations where support is necessary and new requirements arise. These could range from university teachers using the resources as complementary material for their courses to students who need a last-minute brush-up for presenting their thesis.

Making resources and training offers for research skills permanently available also addresses the need for learning on demand. Skills cannot be acquired on store and in one step, but require permanent training and refinement. With the help of BASES, learners can train their research skills whenever they need them and in unison with their growing competence and the increasing complexity of their research tasks.

Contrary to the book that we have been working on with little financial support, the design and implementation of the BASES service requires more personpower than we have available at the moment. The project is currently (End of october 1998) submitted to national funding programme by the Austrian ministry of science. We are now shortlisted and have a final hearing in the middle of november in Vienna. We hope to start with the end of the year. A prototype of some of our ideas can be found under http://www.uni-klu.ac.at/~pbaumgar/deutsch/medien/html/21.htm

Summary

Interconnected problems, rapidly changing unstable environments, and an indeterminate future of our society challenge our traditional education system. What is needed is not only factual and procedural knowledge for solving pre-defined problems but the active skill of framing problems, designing desirable changes and inventing ways to bring these changes about.

Research is not a gift based on "talent", "intuition" or "art" but a skilled social practice that can be learned and trained. What we need is a second order language for this training process that satisfies the following criteria:

- definition and isolation of different kinds of research skills and training of these skills
- development of a programme to progressively chunk these different kinds of isolated skills to acquire a gestalt view of the research process
- integration of the challenges raised by new technologies in a self-study socio-technological environment.

We propose the BASES project as a small step in this direction.

References

[1] BAUMGARTNER, P., Der Hintergrund des Wissens, Kärntner Druck- und Verlagsgesellschaft, Klagenfurt, 1993.

[2] BAUMGARTNER, P., PAYR, S., Learning as action: A social science approach to the evaluation of interactive media, in: Carlson, P., Makedon, F. (eds.), Proceedings of ED-MEDIA 96, AACE, Charlottesville, 1996, pp. 31-37.

[3] BUCKINGHAM SHUM, S., Negotiating the Construction and Reconstruction of Organisational Memories, Journal of Universal Computer Science (Special Issue on IT for Knowledge Management), 1997/3 (8), pp. 899-928.

[4] CHAIKLIN, S., LAVE, J. (eds), Understanding practice: Perspectives on activity and context, Cambridge University Press, Cambridge, 1993.

[5] COGNITION AND TECHNOLOGY VANDERBILT, Anchored instruction and its relationship to situated cognition, Educational Researcher, 19/1990, pp. 2-10.

[6] COLLINS, A., BROWN, J.S., NEWMAN, S.E., Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics, in Resnick, L.B. (ed.), Knowing, learning, and instruction, Erlbaum, Hillsdale, NJ, 1989, pp. 453-494.

[7] DILLENBOURG, P., BAKER, M., BLAYE, A., O'MALLEY, C., The evolution of Research on Collaborative Learning, http://tecfa.unige.ch/tecfa-people/dillenbourg-all.html, 1996.

[8] DREYFUS, H.L., DREYFUS, S.E., Mind over Machine, Free Press, New York, 1986.

[9] LAURILLARD, D., Rethinking University Teaching: A Framework for the Effective Use of Educational Technology, Routledge, London, 1993.

[10] LAVE, J., Cognition and practice. Mind, mathematics and culture in everyday life, Cambridge University Press, Cambridge, 1991.

[11] LAVE, J., WENGER, E., Situated Learning: Legitimate peripheral participation, Cambridge University Press, Cambridge, 1991.

[12] MEEHAN, E.J., The Thinking Game: A Guide to Effective Study, Chatham House, 1988.

[13] READ, S., Thinking About Logic, Oxford University Press, Oxford, 1995.

[14] RODRIGUES, D., The Research Paper and the World Wide Web, Prentice-Hall, Upper Saddle River, 1997.

[15] SCHÖN, D.A., Educating the Reflective Practitioner. Toward a New Design for Teaching and Learning, Jossey-Bas, San Francisco, 1987.

[16] SCHÖN, D.A., The Reflective Practitioner: How Professionals Think in Action, Basic Books, New York, 1983.

[17] SPIRO, R.J., JEHNG, J.C., Cognitive flexibility and hypertext: Theory and technology for the nonlinear and multidimensional traversal of complex subject matter, in Nix, D., Spiro, R.J. (eds.), Cognition, education, and multimedia: Exploring ideas in high technology, Erlbaum, Hillsdale, NJ, 1990, pp. 163-205.

[18] GOVIER, T., A Practical Study of Argument, Wadsworth, Belmont, CA, 1997.