Journal of Network and Computer Applications (1999) **22**, 000–000
Article No. jnca.1999.0081, available online at ...

Web-based training, performance and controlling

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On-line media and self-directed learning environments are among the most effective training solutions in terms of cost, time and logistics. In the last few years, the percentage of employees participating in training courses has increased. At the same time, there has been a decline of training budgets. Therefore, careful educational controlling must guard direct and indirect costs listed by amount, mode and source. Additionally, the success of on-line courses must be measured in terms of training and functional sectors. Most educational departments generally use controlling processes which consist of consecutive phases. Modern economic controlling, however, focuses on the permanent improvement of process outcomes. Recent examples of Web-based training courses and on-line tools illustrate how continuous feed-forward and feed-backward loops may be implemented in on-line learning. Controlling the transition from learning to working and checking the sustainability of learning outcomes improves the quality and success of training and makes it possible to calculate the success of training applications. Thus, modern educational controlling approaches should be introduced which comprise exact calculation of financial investments and gains, optimal planning of organisational processes and goal-oriented definitions of strategical and operational learning objectives. Web-based training will then allow the educational and IT staff to take over a strategical role to establish an innovative learning and working culture.

1. More training for less money

Traditional means of education are no longer adequate to meet the needs of life-long learning. Continuous education for large numbers of people appears to be unrealistic if conventional strategies are pursued. Even where available, the quality of education does not meet the high standards of international business. Furthermore, in many countries public and private funding for educational services are declining while costs rise faster than income levels and tax revenues. Therefore, electronic distance education will become a major source for ongoing education in the international knowledge-based economy [1]. The marketplace for many educational services within the banking sector will expand international or even global—with great increases in the quality of education available to the individual at lower real costs per capita than conventional education today. Computer, television, satellite, fibre optics and other technologies combine to create a vast interactive communication and information network [2].

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In 1998, the German Economical Institute (IDW) published the results of its study about on-going education in Germany between 1992–1995: about 75% of all employees participated in training courses and this percentage increased about 10% during the course of the study. At the same time, the educational budgets were reduced by nearly 10% (resulting in 34 billion German Mark = US$20.5 billion)—at an average of 1670.00 German Mark (US$ 1000) per employee.

The banking sector is leading the development and adoption of electronically supported workplace training and is now moving towards distance education and integrated multimedia learning environments to accommodate the scale of vocational training and communication requirements. Today, many distance learning projects are realized by means of conventional media, such as printed matter and telephone hotlines. There is an emerging consensus that banks must invest in and provide access to a complete range of training programmes for their employees from basic skills to high-end management and technical skills training. Electronic performance support systems (in the form of on-line media and self-directed learning environments) are among the most effective training solution in terms of cost, time and logistics.

Therefore, some German banks have already reduced their face-to-face training courses by approximately 30% p.a. and all major banks are now introducing Web-based training (WBT) as a means for cost effective training. During the same period of time, German banks experienced a considerable increase of training costs: major German banks and bank associations spent between 88% and 136% more money on training in 1996 than in 1989 [3]. A closer look at these data reveals there was a dramatic increase of training costs between 1989 and 1993. Since 1994, there has been a decline of training budgets at the same rate as in other business sectors. Banks are spending 6% of their personnel budgets for training but 15–30% of their administrative and operational budgets for information and communication technology (ICT). For instance, the largest of German banks, Deutsche Bank, spent 340 million German Mark (US$ 205 million) on training and 2.3 billion German Mark (US$ 1.3 billion) on ICT. This translates into approximately 4200 German Mark (US$ 2500) for training and 6700 German Mark (US$ 4000) for ICT per employee [4]. Banks and insurance companies have always been among the pioneer users of new technologies. In Germany, 30% of all insurance companies and 15% of all banks are actively using multimedia. More than 50% are planning to do so in the future. More and more, tele co-operation is applied in order to support training-on-the-job, counselling, and customer services [5].

2. The cost of training

The overall cost of training and on-going education are divided into direct and indirect costs. Direct costs consist of external costs, such as rooms, travel,

accommodations, material and trainers, as well as internal costs, such as salaries and administrative costs. Indirect costs are elicited by lost-production costs and consecutive costs, such as higher wages of highly trained employees.

Some simple guidelines may help to calculate the costs of web-based training as compared to face-to-face courses: computer-based training (CBT) and Web-based training takes 50–70% of the study time of a traditional learning course [6, 7]. Highly efficient WBT may even reduce the study time to 30–50% of the original study time. One hour of learning requires 40–50 pages in WBT, approximately one month of development and a budget of 50 000 German Mark (US$ 30 000). Given these rough cost estimations and the average costs for travel, accommodations and trainer income, it is possible to compare the costs of face-to-face courses and WBT: if 100 employees participate in a three day face-to-face training, the costs will be between 700 and 1400 German Mark per participant (US$ 420 and 840 respectively). CBT and WBT may be provided for a rate between 600 and 1100 German Mark per participant (US$ 360 and 660 respectively). It must be considered that sophisticated WBT, with the support of on-line tutors and moderated chats or bulletin boards, may result in even higher costs than simple face-to-face training [8]. On one hand, there is clearly a trade-off between cost reduction and support quality. On the other hand, cost reduction is not the only end of WBT. In fact, one of the outstanding cost factors is quite frequently overlooked: time-to-market, which is the time from product development to market introduction.

A complete cost analysis takes into account all direct and indirect costs listed by amount and mode. A crucial point is to identify the source of the costs: e.g. the department which demanded the development of a certain training course. Some WBT systems in German banks use individual ‘training accounts’ which gives each employee the opportunity (and the obligation) to monitor the cost of his personal training course. A comprehensive cost analysis helps to identify and calculate alternative forms of training courses, forms the basis of prognoses and planning processes and is necessary to perform comparational analyses [9].

3. Learning efficacy and cost efficacy

Many problems arise when a systematic controlling of on-line learning processes shall be employed. A major obstacle is an inadequate learning and communication culture which does not support the free flow of information but facilitates competition between employees who in turn are not ready to share their knowledge with others. ‘Learning in electronic media’ is a WBT which helps to overcome deficits in computer literacy and learning culture [10]. A major German bank uses the course modules to introduce a platform for WBT administration and delivery (cf. Fig. 1). Bank Academy, therefore, designed the course as a generic Web-based training system that can be used as a stand-alone training course or as an integrated help system supporting other Web applications. Thus, it can be used

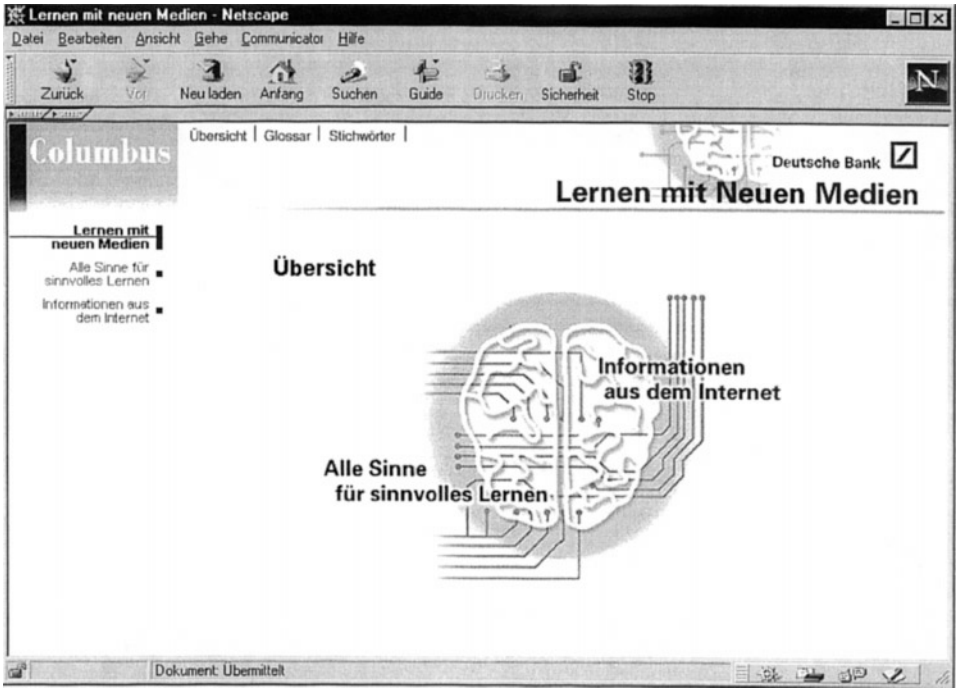

Figure 1. The Web-based training 'Learning in electronic media' helps bank employees to grasp the basic navigational skills and learning techniques to successfully cope with Web-based learning environments (copyright by Bankakademie, developed in charge of Deutsche Bank AG).

as a Performance Support System (PSS) to enhance utilising electronic media in learning and in working environments [11]. The PPS provides four modules, a comprehensive glossary, a keyword and a full-text index as well as a graphical overview with brief summaries of all modules. The table of contents comprises the following topics: learning with multimedia, information from the Internet, e-mail and computer conferences, and learning strategies for WBT. Each module is accompanied by a brief self-test enabling the user to check his or her knowledge on the subject matter. In order to motivate users to apply learning strategies, Bank Academy integrated 50 so-called brain tests: each brain test consists of short psychological experiments which can be easily conducted within a few seconds and illustrate important features of human perception and human memory. Initial experiences ascertained that it is both amazing and highly motivating for students to test their own perceptions and learn about human cognition.

Another problem is that the departments which are responsible for Human Resource Development (HRD) generally do not define strategical and operational goals which can guide the training and controlling processes. An obvious shortcoming in many training courses is a lack of knowledge about the target audience and its needs. Therefore, it is suggested to implement an user-centred design process which involves end users and does not solely rely on expert information

[12]. It is helpful to control for homogenous learning teams with the same status of prior knowledge and motivation. Integrating users in the design process may enhance the motivation and ascertains to assume the correct level of prior knowledge. Furthermore, it is important to underline the importance of new ICT in education as an investment in the future of the corporation—and not 'just another IT roll-out'. Thus, educational controlling must consider not only the costs of the training courses but also the outcomes. The crucial success factor of training is the transfer of information learned from the WBT into practice. However, this will require removing learning processes from its isolated position in training centres and dedicated training PCs; learning must be integrated into the workplace environment. It is clear that WBT, as an integral part of the corporate Intranet, is best suited for providing a combination of information, learning, and communication services which support working and learning.

The success of on-going education is measured in terms of training and functional sectors. Training success consists of user acceptance (e.g. a survey with individual acceptance ratings) and learning performance (e.g. knowledge tests before and after a training course). Important parts of functional success are the individual performance at the work place and the performance gains of the department or corporation as a whole. They can only be measured, if educational goals are pre-defined. Assessment tools, such as surveys, questionnaires, and knowledge tests, support educational controlling optimally, if they are an integral part of the WBT. Bank Academy has developed the database CertiFire® to create, maintain and deliver exercises and tests within various environments from one source: print-outs, stand-alone applications, and Java applets to be integrated in WBT [13]. A broad range of interaction types have been implemented which enable CertiFire to provide surveys concerning acceptance ratings, to conduct knowledge tests and to store and process the input data. Figure 2 displays an example for a test evaluation form of a WBT which has been developed in charge of General Motors Acceptance Company (GMAC): after having passed an on-line exam, the user has the option of filling in his or her name on an evaluation form and to submit the learning results voluntarily. Of course, it is possible to store the data mandatorily and automatically by the system itself. However, in many European countries strict rules of personal data security and individual performance controlling must be regarded which do not allow for automatic data collection and storage.

4. The process of controlling

Most HRD and educational departments generally use stepwise controlling processes which consist of the following consecutive phases:

(1) Needs analysis—define strategical and operational goals and needs;
(2) Conception and planning—define learning objectives, decide to make or to buy, apply adequate didactics and organisational preparations;

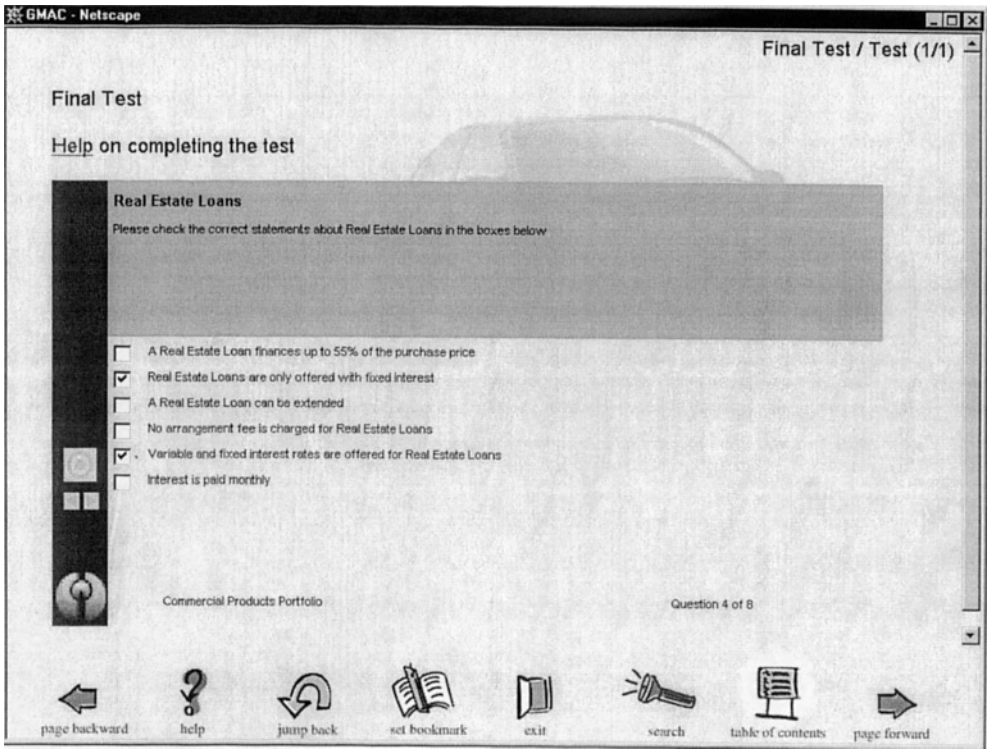

Figure 2. A Web-based training developed by Bank Academy in charge of Raytheon Training and General Motors Acceptance Company combines off-line and on-line elements, such as CBT-like navigational aids, search facilities, bookmarks and the test database CertiFire®.

(3) Delivery and conduction—control and support learning processes, collect evaluation data on-line and offline;
(4) Evaluation and transfer—analyse evaluation data and control transition to the work place.

Although this schedule appears somewhat comprehensive, it does not address the needs of an on-going learning process which permanently delivers information, learning, and communication services to learning stations and work places [14]. Modern economic controlling does not focus on strict schedules but on the permanent improvement of process outcomes. Therefore, modern controlling is a highly interconnected process which starts with the definitions of goals, problem analyses and prognoses, which rely on benchmarks and judgement of reasonable alternatives. A decision is made based on the data from these early stages and the realization is evaluated in order to come up with an detailed comparison of problem analyses and goal definitions. This comparison is used as feedback to adjust the following goal definitions. The feed forward loop from goal definition

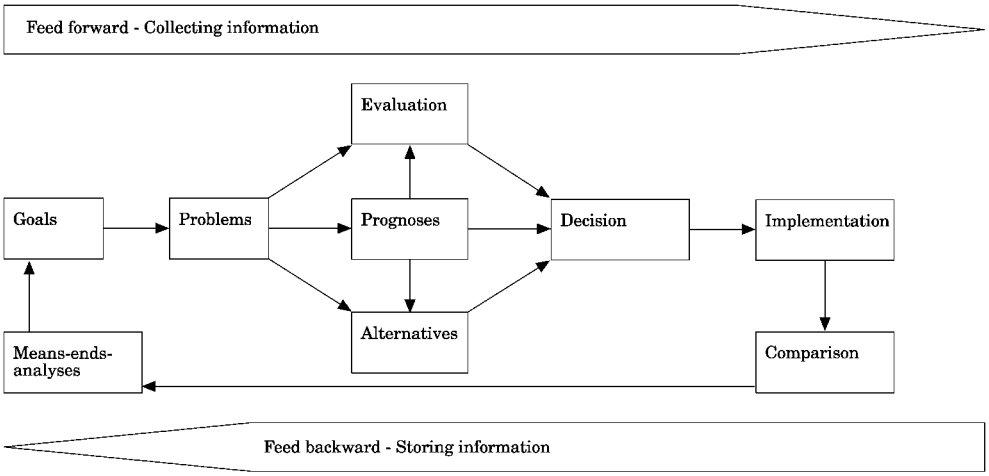

Figure 3. A comprehensive model of a modern on-going controlling process [14].

to evaluation is used as a fact finding process whereas the feed backward loop is used to store relevant data and lessons learned (cf. Fig. 3).

From an economical point of view it seems clear that costs can be reduced drastically. Little is known, however, about the effects of tele co-operation upon corporate culture, learning behaviour, and communication processes [15, 16]. Several studies compared computer conferencing via e-mail, video-conferencing, telephone conferences and personal communication. These studies determined that video-conferencing is much more similar to telephoning than to personal communication. As Sproull and Kiesler discovered, simple e-mail conferences can provide several advantages [15]: personal communication takes less time but electronic mailing leads to agreements more frequently. Additionally, conferencing by e-mail allows for a more symmetrical participation than personal discussions. Banks and their HRD departments aim to take advantage of these new technologies.

A WBT about currency management developed by Bank Academy in charge of a major German bank illustrates how feed forward and feed backward loops may be implemented in on-line learning. The WBT is based on the Hyperwave information server [17] and the learning platform TrainingSpace (formerly GENTLE [18]). This software stores and maintains the user interface (e.g. buttons, frames), the structure (e.g. links, hierarchy of pages) and the actual content (e.g. HTML-pages, images) separately. Thus, all complete WBT pages are composed on demand and may contain individual information, such as notes and user defined links, without interfering with the contents of the WBT delivered to other users.

Bank Academy conducted a pilot study with 70 participants. Half of them were pooled in learning teams with five people each and the other half studied

individually. All participants were allowed to take notes and write contributions to the discussion forum. All notes and contribution were typed according to their contents, that is the user decided whether she or he wants to type in a question, an answer, an agreement, a disagreement or a simple remark. All notes were linked to a particular phrase or page in the WBT. Additionally, different access rights could be attached to each note: public, learning team (if available), and private (private notes were marked with grey icons, public notes with green icons). All notes containing questions were sent as an email to an expert who decided whether he or she wanted to respond to that question. The notes which had been responded to by an expert were marked with an blue icon. All public notes were copied to the discussion forum with a link in the note enabling the user to access the anchor of the note by clicking on that link. The WBT consisted of five modules consisting of approximately 120 pages each. Each user took an average of four notes per module and additionally wrote one or two messages to the forum. Most of the notes were public. The notes did not only support the learning process by motivating the users to discuss the subject matter of the WBT. They also provided an tremendously useful source of information for the adjustment and improvement of the system, because the user took lots of notes which describe technical or design problems. Furthermore, a background library of encyclopaedias and news services enabled the user to access a vast amount of background information and most recent information without leaving the WBT environment (cf. Fig. 4; [19]).

WBT clearly has the capability to support feed forward and feed backward processes: notes can be linked to particular pieces of information in the WBT and copied to a forum. Colours and icons can indicate the content and access rights of notes and forum messages; messaging systems support the flow of information between individual learners, learning teams and subject matter experts; frequently updated information and background libraries allow the WBT to be up-to-date even in rapidly changing environments. In order to account for the various roles and uses of WBT in a modern business environment, two areas of controlling data should be regarded [20]:

- Controlling of learning outcome
  - Acceptance data (e.g. surveys, interviews, group discussions); 48% of all German banks collect acceptance data.
  - Performance data (e.g. study time, learning outcome, stability and sustainability of the learning outcome); about 25% of the German banks collect performance data systematically.
  - Problem solving and transfer (e.g. case studies, workshops, observation and judgements in the work place); 73% of the German banks use at least one of these methods.

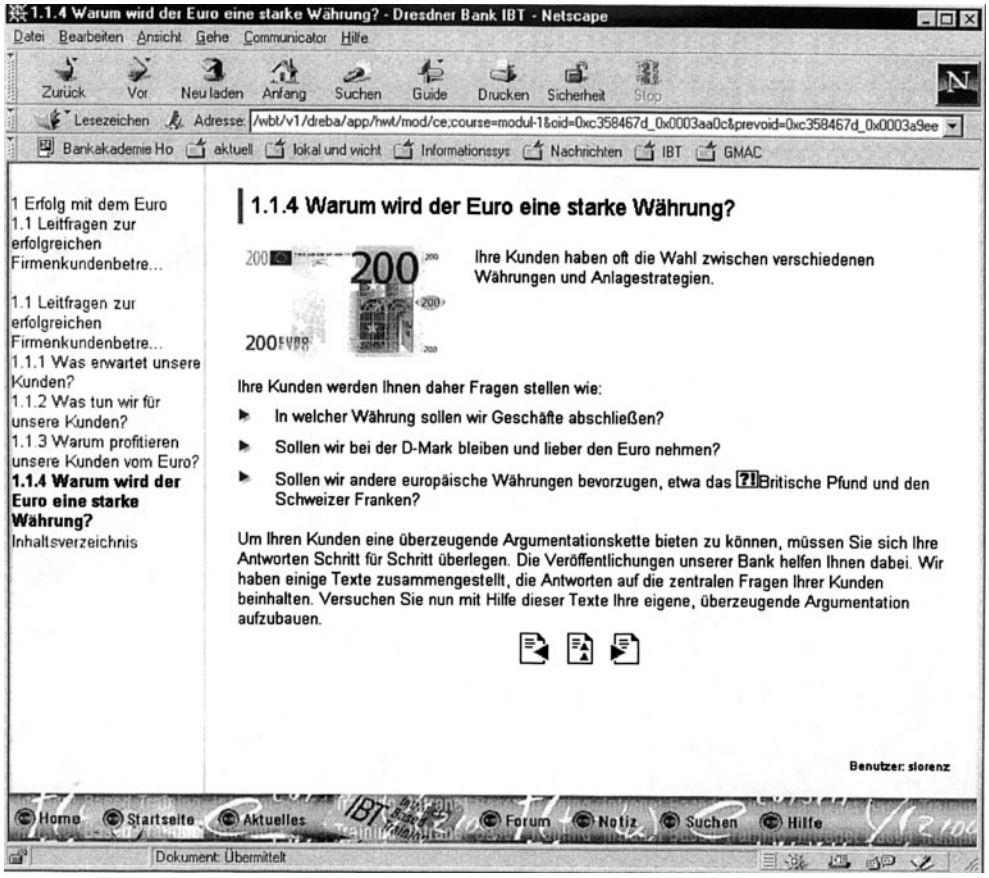

Figure 4. A WBT produced in charge of a major German bank comprises five training modules on 'foreign currency management', search facilities including additional background libraries, note taking, discussion forums and an e-mail-based messaging system to exchange questions and answers between students and experts (this would be marked with a blue icon in the text).

- Career development (e.g. individual discussions with employees, evaluation of the individual career steps); only 52% of all banks regularly evaluate the career development of their employees.
- Corporate success (e.g. controlling of corporate and department goals, sustainability of the success); probably nearly 100% of the banks are engaged in regular evaluation of their success measurements.

It has to be regarded, however, that most of the data mentioned above (e.g. acceptance and performance ratings) are independent and do not correlate with one another significantly [21]. Therefore, missing data cannot not be estimated referring to another set of data. The other area of controlling is described in the following list:

- Controlling of transfer
  - In the work place
    - Overall acceptance ratings of the learning environment
    - Observations (e.g. team discussion, work performance)
    - Judgements (e.g. regular evaluation meeting and individual judgements of employees)
    - Follow-up (e.g. workshops of regional teams which adapt generic training courses to their particular needs)
  - Directly after training
    - Knowledge tests (e.g. self tests, examinations, comparison of pre- and post-tests)
    - Discussion between employee and employer
    - 'Transfer partnership' or learning groups discussing the learning outcomes

Controlling the transition from learning to working and checking the sustainability of learning outcomes are the crucial factors which improve quality and success of training—and makes it possible to calculate the success of training applications, doing away with guess work.

5. Calculating success

Pichler [22] conducted a nationally awarded study on marketing and counselling training for retail bankers of a German bank. He found costs to be approximately 1400 German Mark (US$ 840) per participant per day. The net income resulting from the training was about 4400 German Mark (US$ 2600) per participant in the first year. Comprehensive scoring models must be employed in educational controlling in order to come up with reasonable calculations of training costs and income. Kaplan and Norton [23] have suggested such a model consisting of 'balanced score cards', which take into account financial data, innovation rates and customer satisfaction. All cards are rated using scores derived from historical corporate data and benchmarking. Benchmarking and the use of control groups without training help to estimate the gains of training investments. However, there is no linear correlation of learning effort and learning outcome. A rough estimation states that 50% of the efforts produce about 80% of the results, that is: there is much more effort needed to get slightly better results, if the level of performance is already high (cf. Fig. 5; group 1 and 2).

The graph depicted in Fig. 5 illustrates the non-linear correlation of learning effort and learning outcome. Having defined the learning objectives once, the graph identifies the investment needed to achieve these goals. Moreover, the

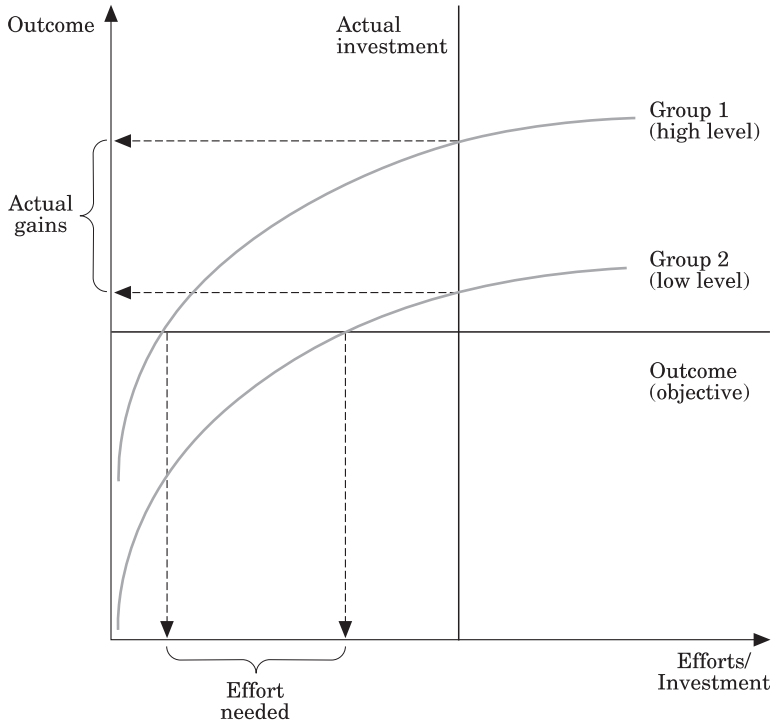

Figure 5. The non-linear function of learning efforts (investments) and learning outcome—if a learning result has been defined, the necessary effort can be identified (and vice versa).

probable learning outcome may be estimated if the actual investment has been predefined. The graph does not only provide a rough understanding of the correlation of the different factors. It may also be used to calculate numerical parameters of a statistical function that provides a sound estimation of the financial benefits from various levels of efforts and outcomes (e.g. [24] pp. 159). Critical parameters are: the percentage of persons of the target groups that is able to fulfil the learning objectives (criterion), the percentage of persons of the target group who pass the test or exam (selection) and the correlation of criterion and selection procedure (validity).

In order to calculate the following terms all individual scores are given as the z-score:

$$z = \frac{x_i + \mu}{\delta} \quad \text{with}$$

$$\mu = \frac{1}{n} \Sigma x_i \quad \text{and}$$

$$\delta = \sqrt{\frac{1}{n} \Sigma (x_i - \mu)^2}$$

Therefore, the z-score is given by the subtracting the arithmetic mean from the individual values and division by the standard deviation. This procedure ascertains that all values are normally distributed with a mean of zero and a standard deviation of 1. With perfect selection, the average z-score of the selected learners would be the average work performance resulting from the training investment. The work performance, however, will be dependent on the accuracy of the selection, that is the validity of the test procedures involved. The validity of the knowledge test can be estimated by calculating the linear correlation of the test scores and a independently measured criterion, e.g. using methods of transfer controlling. The linear correlation of two values is given by:

$$r = \frac{\rho_{x,y}}{\delta_x \delta_y} \quad \text{with}$$

$$\rho = \frac{1}{n} \Sigma x_i y_i - \mu_x \mu_y$$

A conservative rule of assigning financial values to performance measurements is to assume that 40% of the salary is assigned to each standard deviation of performance. This leads to the following estimation of the financial benefits from training investments:

$$benefit_{\$} = \frac{N}{n} \cdot r_{test,criterion} \cdot d_{year} \cdot c_{year} \quad \text{with}$$

N = number of candidates in the training (e.g. during one year)

N = number of selected candidates by test scores (e.g. in one year)

r = validity of test

d = duration or number of years candidates will stay

c = number of candidates tested per year

6. Conclusion

Several conclusions can be drawn from this course of reasoning: the financial gain is enhanced if there are many adequate candidates, a low selection ratio and tests of high validity. All these parameters cannot be estimated and controlled in a short period of time. Educational controlling, therefore, demands an on-going collection of adequate data during a given period of time. Initial positive results cannot be expected within the first six months. However, collecting and analysing educational data is worth the effort: computer programmer aptitude tests were used to select computer programmers in the US; with a selection ratio of 50% gains of between 13 and 37 million US$ could be expected in one year [24]. Using educational controlling procedures may also have such enormous

positive effects. All relevant data needed to calculate the financial gains can only be collected and evaluated in an on-going controlling process. Additionally, data derived from such a controlling process support the evaluation of historical corporate data as well as planning the future.

Thus, Web-based training should not be viewed as a simple extension of traditional computer-supported learning approaches. It should be used to introduce a modern controlling approach which comprises exact calculation of financial investments and gains, optimal planning of organisational processes and goal-oriented definitions of strategical and operational learning objectives [25]. Web-based training will then allow the educational and IT staff to take over a strategical role to establish an innovative learning and working culture within the corporation. Web-based training will be a successful complement to traditional ways of delivering training if it proves to be a solid basis for goal-oriented planning and cost-effective training solutions.

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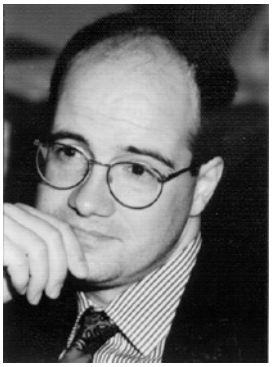

Joachim Hasebrook was born in 1963. He studied psychology and computer science at the University of Marburg and wrote his PhD thesis about learning with hypermedia systems at the University of Giessen, Germany. Dr Hasebrook wrote expert opinions about effective learning with multimedia and interactive distance learning environments in charge of the German Parliament and the Scientific Options Assessment (STOA) of the European Parliament, respectively. Dr Hasebrook worked as a project manager for electronic media at a German publishing and software house. He has been a member of staff at the Bank Academy in Frankfurt, Germany, and currently holds the position of the Head of the Department 'Concept & Programme Development'.