A critical review of research on technology-based training in business organizations

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ABSTRACT

This paper critically reviews the recent literature on technology-based training in the business organizations. For doing so, the literature is examined from three main perspectives: effectiveness, efficiency, and technology affordances. Based on this examination, the paper identifies the lack of theoretically grounded models that distinctively address the issues of evaluating "technology-based" training programs. The paper then concludes by calling for an interdisciplinary approach to develop evaluation models that help instructional designers to understand which form of technology is effective under which specific circumstances.

Keywords: Technology-Based Training (TBT), evaluation, business organization, effectiveness, efficiency, technology affordances.
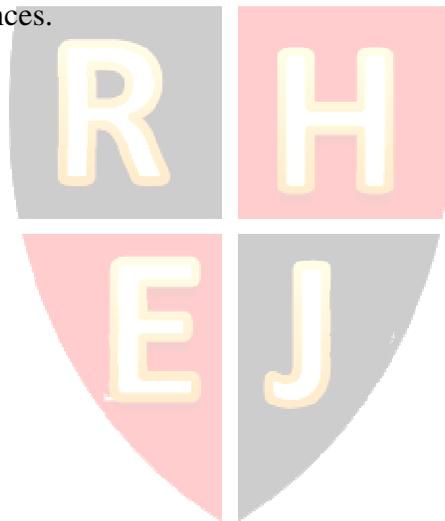
INTRODUCTION

The history of training in business organizations is as long as the whole history of business organizations (Miller, 1996) because the knowledge base or skills of the normal employees in the labor market were not sufficient for the specialized tasks within the organizations. The academic study of various forms of training, however, did not start until about a century ago (Salas & Cannon-Bowers, 2001), when researchers started a branch of research under the name of "vocational training" (Taylor, 1916, 1947). Today, we are witnessing an overwhelming number of research studies from both descriptive and prescriptive traditions, focusing on several characteristics of training programs as well as their costs and benefits for business organizations. At the same time, organizations have come to better understand the significance of training for their survival in knowledge-intensive and volatile markets of this era, and thus have increasingly acknowledged the profitability of developing their human resources through various forms of training (Becker & Gerhart, 1996; Berge, 2001; Salas & Cannon-Bowers, 2001). This situation has provided an unprecedented opportunity for research in the area of training, because many organizations embrace researchers to come and conduct experiments or interventional research there with the hope of using their results for developing more effective training programs.

Meanwhile, the recent decades are marked with a boom of technology. Technological advancements come with a rate faster than any period in the human history. With the promise of providing various economic advantages, technology soon penetrated in the working of organizations and all their processes and practices have come to be influenced by new technologies (Dussauge, Hart, & Ramanantsoa, 1992). Human resource departments of organizations, and their training practices, are no exception. As digital technology such as computer and then internet became incorporated in different phases of training, previously in design and now even in delivery, a new phenomenon took shape: Technology-Based Training (Ravet & Layte, 1997; Sunoo, 1998). Technology-Based Training (TBT) is a form of training in which digital technology is purposefully applied as a tool to deliver Knowledge, Skills and Abilities (KSAs) required for the improvement of on-the-job performance (Salas & Cannon-Bowers, 2001; Schreiber & Berge, 1998). TBT in today business organizations has already spread into diverse forms including but not limited to: 1) Computer-Based Training (CBT) including help menus, tutorials, simulations, and single-user games; 2) Network-Based Training (NBT) including tutorials or multi-user games on local or regional networks, and Electronic Performance Support Systems (EPSS); 3) Web-Based Training (WBT) including e-learning programs; 4) Training through digital devices other than computers, such as some forms of videoconferencing, simulation cockpits, etc. Some examples mentioned in each of these four forms (e.g. games) may belong to more than one form depending on their design specifications.

TBT has spread rapidly in business organizations because of at least four reasons: First, it is generally believed that technology increases the effectiveness of training (e.g. Strother, 2002; Sunoo, 1998). Second, the cost of designing and delivering TBT is perceived to be less than traditional forms of training (e.g. Bell & Kozlowski, 2002; Brown, 2001; Ravet & Layte, 1997). Third, TBT is assumed to help organizations with the challenges of globalization among which one of the most pressing is the diversity of organizational workforce in terms of their geographical place, their preferred mode of learning, and the degree of comfort and experience with technology (Bell & Kozlowski, 2002; Brennan, McFadden and Law, 2001; Touger, 1997).

And fourth, as technology has become socially associated with excellence and advancement, organizations adopt technology in several aspects of their structure including training programs to utilize the symbolic advantages of that (e.g. Chan & Ngai, 2007; Meyer & Rowan, 1977; Orlikowski, 1992). The speed of research on TBT particularly at the empirical level, however, has been slower than the penetration of technology into organizational training programs (Alavi & Leidner, 2001; Berge, 2001; Salas & Cannon-Bowers, 2001). Therefore, the general belief on the unconditional power of technology as a genie that solves every problem and improves any situation has dominated the mindset of organizational managers. As a consequence, human resource departments and particularly, instructional designers found themselves under enormous pressure of various stakeholders such as top management as well as customers to incorporate technology in the structure of their training (Brennan, McFadden, & Law, 2001; Ely, 1999; Salas & Cannon-Bowers, 2001). This leads to the main gap in the literature of training, which is the lack of research on analysis and measurement of circumstances under which technology works towards the desired organizational learning objectives.

This review is structured along three main themes. Each of these themes captures one major perspective on TBT. In the first theme, the focus is on how recent literature evaluates the success and effectiveness of TBT. Then it is discussed how training research engages with the economic aspect of TBT, particularly focusing on the Return on Investment (ROI). Finally, the third theme highlights how the affordances and constraints of technology are viewed in the literature of TBT. It is also worth noting that this literature review focuses on TBT only in the context of business organizations while researchers also has studied other types of organizations including higher education institutions, medical and health organizations, and military.

FROM THE PERSPECTIVE OF EFFECTIVENESS

Since technology started to change how training is delivered, it has also changed how to evaluate its effectiveness (Touger, 1997). Although effectiveness is the most common indicator for distinguishing between a successful and a failing training program, this concept "remains a poorly explained concept" in both the general literature of training and the more specific literature on TBT (Brennan, McFadden, & Law, 2001: 4). Rather than learning outcomes, researchers most often use a host of other variables as proxies for the effectiveness. The best definition implied from the recent business training literature is that effectiveness is a measure of how well the desired organizational learning goals have been attained.

So far, there is no consensus among researchers on the best approach for evaluating the effectiveness of training programs including TBT (Long & Smith, 2004; Salas & Cannon-Bowers, 2001). Except for very few theoretical frameworks that are developed specifically for some forms of TBT (e.g. Schreiber & Berge, 1998), most of the TBT literature still use the models and frameworks of traditional training or learning environments with minor modifications. For example, Magnussen (2008) employs Fink's taxonomy of significant learning for evaluating the effectiveness of WBT. Another example is Ravet and Layte's (1997) work which uses Kolb's learning cycle as a general model for assessing the success of TBT. Nonetheless, the preeminent model in the literature of training and TBT is Kirkpatrick's typology (Kirkpatrick, 1959a, 1959b, 1960a, 1960b) which outlines four categories of measures for the effectiveness of training outcomes. Although this model is developed about fifty years ago, it is still the most popular and credible framework for evaluating the effectiveness of different forms of business training (Alliger & Janak, 1989; Salas & Canon-Bowers, 2001;

Touger, 1997) including TBT (e.g. Hoekstra, 2001; Olafsen & Cetindamar, 2005). Along this long time, several revisions, extensions, and expansions for the typology have been suggested to account for new changes in the training landscape (e.g. Kirkpatrick, 1998; Philips, 1996), particularly for TBT (e.g. Strother, 2002). Some researchers, on the other hand, criticized Kirkpatrick's model (e.g. Alliger & Janak, 1989; Philips, 1997) so strongly that there is now no doubt that we need a new simple still systematic framework for evaluating the effectiveness of training (Salas & Canon-Bowers, 2001; Touger, 1997). Furthermore, literature shows that most of the research on training evaluates only the lower levels of learning in Kirkpatrick's taxonomy, which do not show the degree of knowledge transfer to the on-the- job performance of the trainees. This is more the case in studies on TBT such as in research on e-learning environments (Brennan, McFadden, & Law, 2001; Strother, 2002). This problem leads to little or no impact of TBT program evaluations on improving strategies, design, and implementation of training in business organizations (Houldsworth & Hawkridge, 1996). So rather than just criticizing the Kirkpatrick's model, future research can start evaluating higher levels of that model.

In conclusion of the presented arguments about the effectiveness of TBT and based on the critiques of the existing evaluation models even for traditional training programs, developing a new model for evaluating the effectiveness of TBT is strongly suggested. Furthermore, as the economic aspect of knowledge and education, particularly in training, is increasingly more demanded and appreciated (Lyotard, 1984), economic analysis is going to be inseparable from any kind of training evaluation (Touger, 1997). With TBT's promise of economizing on the training, evaluation of effectiveness should always be tied to evaluations of efficiency.

FROM THE PERSPECTIVE OF EFFICIENCY

Efficiency is a term coming from economic and business perspectives and stands for measuring how well the input resources are consumed to gain the desired output (Farrel, 1957). Based on this definition, an efficient system is either a system that proceeds with the minimum amount of resources (time, money, energy, etc.) or a system that produces the maximum gain for a given input and technology. An efficient training program then is a program which uses the minimum costly resources (such as implementation costs) but results in maximum gain or benefit (such as increase in sales). Thus, efficiency is a measure for evaluating profitability of a training program usually in a monetary scale, because for calculating it all the input and output should be converted to a single meaningful scale which for business organizations is usually money (Philips, 1997). Although efficiency is quite different from effectiveness, in the case of business training this measure has been included in higher levels of effectiveness evaluation in the most frequently used models of training (e.g. Kirkpatrick's taxonomy). This economic view to the concept of training effectiveness particularly for TBT fits into the Lyotard's notion of change in the nature of knowledge after technology has taken over our lives in our postmodern era (Lyotard, 1984). From the perspective of this influential scholar, in today's society the knowledge gained through education and training is viewed as a product that is valuable not because it is true but because it is saleable, efficient or "performative" for the business organization (Lyotard, 1984: 41). That is why evaluating the efficiency becomes an inseparable part of evaluating the success of a TBT program.

In order to measure efficiency, researchers select different variables for expenses and revenues. The most frequently used variables for calculating cost of training program (Ravet & Layte, 1997 particularly for TBT; see also Philips, 1997) is the money spent to design, deliver,

and assess the training as well as the time spent off-the-job for employees to attend in the training. For calculating the output, the fourth and the highest level of Kirkpatrick's model is the most common criteria, which evaluates the effects of training on business results such as productivity increase, sales increase, cost reduction, quality improvement, decrease in absenteeism rates, and labor turnover (Kirkpatrick, 1960b). In the literature of training including TBT, these two variables of cost and benefit are barely compared to each other and each of them is considered sufficient to show the economic viability of the training (e.g. Ravet & Layte, 1997). Fortunately in recent years, another variable which is one of the representatives of efficiency in the business research has been introduced to the literature of training. ROI which is first introduced by Philips (1996) is defined as a comparison between "the monetary benefits of the [training] program …to the cost of implementation in order to value the investment [on training]". He puts this criterion at the fifth level of Kirkpatrick's taxonomy of training evaluation. As Philips noted, ROI is a comprehensive evaluation formula and all the five levels of training evaluation model is conducted by calculating only this variable.

There are, however, some technical issue about ROI two greatest of which are first, the complexity of isolating the benefits and effects of a training program from other influences, and second, the impossibility of converting all the benefits to monetary value (Philips, 1997, 2002). There is still no standard list of variables which represent all effects of a training program and no standard time frame as a base for calculation of ROI. This problem becomes more challenging in the case of TBT particularly in distance learning environments because of more uncertainty resulted by adding new factors such as technology and distance. Also, it is impossible to convert some variables such as increase in job satisfaction or teamwork improvement to monetary value. On the other hand, the calculated ROI in which such variables are not considered could be misleading. The above mentioned two issues put the accuracy and reliability of the model under question mark. Since the literature of TBT uses the same evaluation model of traditional training, we are also confronting these issues in TBT research. All we now have in the literature is a set of general advices for dealing with these problems in TBT (e.g. Philips, Philips, Duresky, & Gaudet, 2002) which are not precise and practical.

The number of research studies evaluating TBT based on ROI has been increasing in recent years (e.g. Masumian, 1999; Young, 2002). But to further go in this avenue, research should solve the issues associated with the current ROI model. Furthermore, research can benefit by considering other alternatives for the analysis of the profitability of an investment like training, such as Net Present Value (NPV) and Marginal Benefit Cost Ratio (MBCR). So far, the literature of TBT has ignored these alternatives altogether.

FROM THE TECHNICAL PERSPECTIVE

In recent years, the discipline of educational technology has benefited from many insights of educational psychology, and as a result, major advances have occurred in identifying and improving the influence of technology on learning (Koschmann, 1996; Salomon & Almog, 1998; Spencer, 1988). Consequently, many research studies in the literature of training generally, and in TBT particularly, have become concentrated on measuring the influence of psychological factors on the training effectiveness, rather than developing a comprehensive measure for the effectiveness of training. None of those psychological factors alone can represent learning; rather they may just influence learning positively or negatively depending on the specific circumstances. In the context of TBT, these factors are mediated through the affordances and

capacities that specific forms of technology provide. The reflection of these factors in the literature of TBT has provided a list of influential variable as follows: flexibility, interactivity, convenience, self-regulation, autonomy, motivation, accessibility, self-efficacy, goal orientation and so on.

There are tones of studies about TBT that measure at least one of these variables and compare it with traditional training to show the superiority of TBT. But these variables are not sufficient to assure that learning and transfer has happened. Since there is lack of research to clarify the concepts of effectiveness in TBT (Brennan, McFadden, & Law, 2001), the relationship between these variables and learning has remained vague (Clark, 1994; Kozma, 1994). Moreover, the influence of the instructional strategies on learning is more than these capacities and affordances. So affordances may become limitations if instructional methods do not meet the pre-conditions under which they work (Clark, 1994; Joy II & Garcia, 2000; Kozma, 1994; Ravet & Layte, 1997). Lack of research in comparison among different forms of TBT rather than comparison between TBT and non-TBT also has created the illusion that selecting the best form of technology for training delivery is not the issue (Joy II & Garcia, 2000). Therefore, there is a strong need for more research to clarify the pre-conditions (see for example the work of Young, 2002) and the instructional methods under which specific technological affordances work (Bell & Kozlowski, 2002; Brown, 2001).

CONCLUSION

This paper aimed to review the literature of TBT in a critical way. Major advances in recent years have attracted lots of scholarly attention to TBT and as a result the research in this area is flourishing. Despite giving us a deep understanding and improving the implementation of TBT, however, there still remains plenty of work for researchers. The main need is for a redefinition of pure educational concepts such as effectiveness, knowledge, learning, and transfer in light of the significant changes of business and technology in last decades. Pure economic concepts such as efficiency and profitability should also be redefined in light of changes in education and technology. We need to develop new models and approaches to evaluate these educational and economic concepts in order to clarify how and why learning happens, and then to theorize how training programs contribute to long-term organizational goals.

In conclusion, the research on TBT can dramatically progress in the following two lines. First, the existing massive disconnect between what the research says and what corporations actually do needs to be shifted toward a reciprocal active connection and understanding (Becker & Gerhart, 1996). Second, we should accept that TBT does not belong to one specific discipline rather it is an interdisciplinary field of study. Therefore, answering the questions and puzzles of TBT needs active contribution of various disciplines such as education, psychology, economics, engineering, and management.

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