Human Performance Technology: Research and Theory to Practice

by Harold D. Stolovitch

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Human performance technology (HPT) has made impressive strides since it first became a term and an emerging field of practice in the 1970s (Dean & Ripley, 1997; Gilbert, 1996; Stolovitch & Keeps, 1999a). The dawn of the 21st century finds HPT flourishing. The literature has expanded fivefold in the last 10 years; the number of professional practitioners has multiplied at an even greater rate and the list of academic institutions offering graduate courses as well as full degree programs has become impressive (Stolovitch & Keeps, 1999b). However, along with accelerated growth and presence, a deep concern has also emerged that the practice of HPT is outstripping its theory and research base. In March 1999, at a symposium on appropriate inquiry for HPT, academic leaders voiced alarm at the increasing distance between the practice of HPT and the current scientific underpinnings that support the professional activities of HPT practitioners. Their concerns were echoed by the more than 100 participants at the symposium in their calls for increased, targeted research activity (Sugrue & Stolovitch, 2000).

This article builds from the issues that have been raised by those focused on ensuring that HPT practices are clearly founded on sound theoretical constructs, scientifically derived evidence, and respectable, well-documented professional precedent. It is divided into two parts. The first, which constitutes the main body of the article, presents a "hit or myth game" and then uses research and theory content as a basis for examining each of the game's statements. The second and concluding part offers a series of principles and a golden rule for the members of the HPT community – both practitioners and researchers – to work and live by.

The article is aimed primarily at HPT practitioners caught up with the pressures that emanate from urgent business needs, organizational demands, and the omnipresent concern for the bottom line. It is also relevant to trainers, managers, organizational development specialists, and other professionals seeking to improve human performance in the workplace. Frequently, persistent business pressures create a feeling that there is no time for "theory," dry research articles, or "ivory-tower stuff."

The worlds of professional practice and research are often characterized as being very different. Figure 1 presents a comparison of practice versus research requirements.

Practice	Research
Solve practical problems	Solve intellectual problems
Short time frame	No fixed time frame
Cost-effectiveness	Truth
Multiple and ill-defined problems	Narrowly defined problems
Organizational pressures	Peer pressures
Political considerations	Scientific considerations
Client driven	Theory driven

Figure 1. Comparison of Practice Versus Research.

The overall impression that emerges is one of great divergence between practitioner

and researcher worlds. There is a sense of two solitudes and an implication that to follow one path is to turn away from the other.

Hit or Myth

HPT practitioners base many of their interventions on principles they consider fundamental truths. These drive much of their decision making and professional activities. Examine the eight principle statements in Figure 2 and, as an HPT practitioner, decide whether each of these is true (a hit) or false (a myth). What follows is an examination of each of the hit or myth statements with commentary based on research and theory writings. Discussion of each statement concludes with keys for practice drawn from the research.

Feedback leads to improved performance.

	Hit	Myth
Feedback leads to improved performance.	❑	❑
Immediate feedback is more effective in improving performance than delayed feedback.	❑	❑
Job satisfaction generally leads to improved performance.	❑	❑
Successful performance during training usually results in improved post-training performance.	❑	❑
If you want to learn how to do something, go to the expert.	❑	❑
Physical capital generates a significantly higher return on investment than human capital.	❑	❑
Technology advances since 1970 have consistently accelerated an overall increase in work productivity.	❑	❑
Common sense is a friendly ally of science.	❑	❑

Figure 2. Hit or Myth.

This is one of the most fundamental and frequently cited principles of HPT. It is also intuitively sensible. You do something. You receive feedback on your performance. You improve. Discussions among HPT practitioners often elicit anecdotes to support this statement, as do personal experiences. From where does this notion originally spring? Most attribute the scientific origins of this principle to Thorndike's Law of Effect (1913, 1927, 1932) – which says that when a correct response is reinforced by a reward (for example, "That's correct!"), the reward strengthens the bond between the environment and the appropriate response – somehow equating feedback with reinforcement. However, Thorndike himself noted that feedback interventions can have detrimental properties if viewed in comparison with others (relatively) or if it is vague (indefiniteness) (Thorndike, 1913, p. 288). There is also a large body of research on knowledge of results (KR), knowledge of performance (KP), and feedback interventions (FI) that appears to imply that feedback given to a person who is learning or performing a task results in improvement of performance.

So how does one explain the following two citations?

"Feedback does not uniformly improve performance" (Balcazar et al., 1985).

"Few concepts in psychology have been written about more uncritically and incorrectly than that of feedback…feedback is information, that is, data, and as such has no necessary consequences at all" (Latham & Locke, 1991).

These two affirmations, both by serious researchers, raise doubts about the generalization that feedback leads to improved performance.

To raise even greater doubts about its validity is a recent, very comprehensive review of the research on the effects of FI on performance. Kluger and DeNisi (1996) undertook an exhaustive, rigorous examination of approximately 2,500 studies dating back to the 1890s on feedback and its effects on learning and performance. They critically analyzed 607 effect sizes and 23,663 observations. Their conclusion, drawn from a serious and intensive investigation

of the research and theory writings on this issue, is of immense consequence for HPT professionals. They conclude that the question – "Does feedback improve performance?" – is an inappropriate one. More suitable is "What must one do so that feedback improves performance?" Their key conclusion is that there is a strong need for a consistent and comprehensive theory of feedback to support actions. They suggest that this theory must account for three classes of variables:

Feedback cues. These can shift the learner's/performer's attention to or from a task. They can debilitate performance if viewed as being directed at self and are considered to be "controlling" if they are seen as coming from an external source that does not perceive the person as a valued individual. Feedback cues perceived as motivational (emphasizing gains, accepted as corrective and helpful, or emphasizing benefits) help improve performance. Somewhat unexpectedly, specificity within feedback has mixed effects. Whereas specific feedback can improve performance by removing ambiguity and targeting clearly identified behaviors, it also increases cognitive load through added detail. Research indicates that this is especially true of physical tasks such as a golf swing, dance movement, or delicate medical procedure (Kluger & DeNisi, 1996, p. 273, p.275).

Task. The fewer the cognitive resources required for task performance, the more positive the effect of the feedback intervention on performance. In other words, the simpler the task is for the performer, the greater the impact of the feedback.

Situational. Goal setting increases the feedback effect on performance. The more clear and valued the goal, the greater the impact of the FI on performance. Personality variables affect the impact of feedback. The lower the self-esteem, the greater the externality of locus of control, the greater the susceptibility to cognitive interference, and the less the effect the FI has on the individual.

To summarize in terms of keys for practice for HPT professionals, the research evidence suggests that feedback

– On process and successful outcomes improves performance.

– Appears to have more effect on cognitive than physical tasks.

– Threatening self-esteem has negative effects.

– Has a stronger effect on memory than rule following tasks, that is, it is significantly more powerful in improving recognition and recall (memorization) than application of procedures, principles, or problem solving.

Overall, what appears evident is that a blanket statement such as "feedback leads to improved performance" lacks nuance and can lead to inappropriate decision making. This is an example of the efforts of research and the formulation of scientifically derived theories adding to the HPT practitioner's professional skill in analyzing performance contexts and devising suitable interventions.

Immediate feedback is more effective in improving performance than delayed feedback.

Given the choice, which one would you naturally select, immediate or delayed feedback? Intuitively, immediate makes sense. Then how is it that numerous studies offer contradictory conclusions?

In a study in which trainers taught communicative gestures to individuals with severe retardation, Duke (1995) discovered that delayed feedback resulted in increased accuracy of the training. In a study of cognitive growth and development, van Geert (1991)

demonstrated that the most plausible model of growth depends on delayed feedback. Kern-Dunlap (1992) found that delayed feedback and reinforcement improved desirable peer interactions. Sasaki (1997), intrigued by the rich literature – as well as the findings of his own studies – uncovered numerous instances in which delayed feedback produced superior performance results. As a result, he has generated a theoretical explanation for this phenomenon. Focusing on working memory constraints, Sasaki suggests that immediate feedback can create overload and hence produce an inhibitory effect that lessens its impact.

In terms of keys for practice, the research and theory literature offers HPT practitioners two main recommendations. For simple or neutral tasks, the use of immediate feedback appears to offer beneficial effects. For complex tasks, however, delayed feedback appears to offer superior results.

Once again, research and theory writings provide a more fine-grained and useful perspective on feedback for practitioner considerations.

Job satisfaction generally leads to improved performance.

You are happy; you work harder; you do better. Intuitively, this logic makes powerful sense. Yet what appears to be sensible may, in fact, lead the HPT practitioner to make erroneous decisions. Consider Macan's study (1996) of time management training and its effects on, among other dependent measures, work attitudes and job performance. Macan, from both his own work and other precedents, concluded that there were no main effects or interactions found for job satisfaction. Similarly, Fried, in an extensive meta-analytic study on work satisfaction and performance, found "dissimilarity…in relationships of…performance and…satisfaction…particularly substantial (1991, p.690)." More bluntly, Mannheim et al. (1997) succinctly concluded in their study of personnel in the high-technology industry that job satisfaction and performance are not significantly correlated. Iaffaldano and Muchinsky (1985), in a comprehensive, experimental study of vocational indecision determined that the satisfaction-performance relation constitutes an illusory correlation. They also discovered that information on job satisfaction can significantly bias performance appraisals, a finding substantiated by Smither et al. (1989). On this last point, supervisors who randomly received information on how performers felt about their jobs tended to rate the performance of those they were told "liked their jobs" higher than those for whom they had no information about job satisfaction. They also tended to rate lower in job performance those whom they were told were dissatisfied.

Lee (1992) neatly summarizes the job satisfaction-performance literature with three useful keys for HPT practice. Based on his study of job challenge, work effort, and job performance of young engineers and indepth analysis of the research literature, Lee concludes that managers can obtain improved performance if they provide effective management of work patterns, encouragement, and support of more intensive work effort and job challenge. What powerful material for HPT practitioners seeking support in their efforts to influence management practices!

Successful performance during training usually results in improved post-training performance. This statement appears inherently sensible. If

individuals perform well during training, is it not reasonable to expect that this will carry over to the job? If not, why train? Despite the fact that most training adherents believe and support this, it is a myth against which HPT practitioners have frequently fought. There are many instances when training may be necessary and/or useful. Rarely, however, is it sufficient to achieve sustained improved post-training performance. Convincing organizations to assume a broader performance perspective (Robinson & Robinson, 1998; Fuller & Farrington, 1999) is a constant challenge. This, despite findings such as those of Baldwin and Ford (1988), who, in an extensive review of training research, found that although "…American industries annually spend more than $100 billion on training…not more than 10% of these expenditures actually result in transfer to the job…researchers…similarly concluded…much training…fails to transfer to the work setting." Ford and Weissbein (1997) updated the Baldwin and Ford review and found that while research methodology had improved over the nine years, transfer results remained unchanged. Esque and McCausland (1997) reported that at Intel, one of the most popular and highly rated management courses taken by 600 managers resulted in less than one percent transfer. Figure 3 presents a summary of typical anticipated and actual performance results from courses in which learners perform well during training.

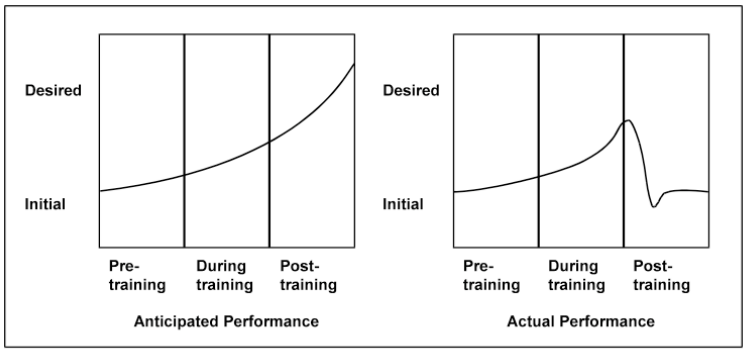

Figure 3. Training-Performance Curve.

Without adequate management attention, performance deteriorates rapidly following training – often to below pre-training performance levels – due to non-supportive or even inhibitory factors. The result is a rapid reversion to familiar behavior patterns. In their study on calculating return on investment in training, Stolovitch and Maurice (1998) identify numerous factors affecting transfer of training results to the workplace.

Drawing from the research and theory literature they found clear guidelines and considerations to help HPT practitioners improve the impact of training on performance. Their keys for practice include the following:

Selection – Ensure that those chosen to participate in training are appropriate for the training. If they will not be able to apply what they have learned to the job within a short time frame, the value of the training investment will be lost.

Preparation – Prior to training, participants require briefings from immediate supervisors that include information on expected application on return to the job for transfer motivation to occur.

Design/Delivery – Training must be well designed and properly delivered in keeping with the characteristics of the learners and their performance needs. This results in appropriate acquisition of skills, knowledge, and confidence to apply back on the job.

Support – Immediate supervisors must provide support, encouragement, and resources post-training to elicit transfer and improved performance.

Feedback – Participants who apply to the job what they have acquired during training require consistent, specific,

corrective, and confirming feedback to improve and maintain performance.

Incentives/Consequences – Doing things differently generally demands additional effort and often initially results in reduced fluency and higher error rate. Participants require personally meaningful benefits to incite them to persist in applying new skills and knowledge.

If you want to learn how to do something, go to the expert.

While intuitively sensible, this statement flies in the face of what the field of knowledge engineering has discovered. Many HPT practitioners have learned from experience that experts cannot articulate the knowledge they use when demonstrating their expertise. This conforms well to a substantial body of theory and research. As Winkles (1992) points out, experts can tell what they do in specific cases but cannot recommend general principles that apply in all cases.

Cognitive psychological research and theory has been suggesting that there are key differences between procedural knowledge (able to do; know how) and declarative knowledge (able to talk about; know what) (Anderson, 1983; Gagne et al., 1993). While experts perform well, not only are they generally inarticulate about what they are doing (unconscious competence), but they often experience greater difficulty in explaining their performance to novices as their expertise increases.

While experts are necessary to provide input into training and to build credibility and depth in content, research suggests other factors that help build effective learning. These include verbalization during learning, which McGeorge and Burton (1989), for example, found led to significantly higher performance. Hattie et al. (1996) conducted an extensive meta-analytic study on the effects of learning skills intervention on learning. They concluded that training other than for simple mnemonic performance should be in context, use tasks within the same domain as the target, and include a high degree of learner activity and metacognitive awareness (pp. 133-134). The emphasis on metacognitive awareness has been a growing theme in the research on improving meaningful learning and post-training results.

The findings of research and theory, in this case, lead to three key principles for HPT practice:

– Do not go to the expert to learn how to do something.

– Draw from the expert as one important input source for engineering the learning system.

– Include verbalization – having the learner speak aloud and explain what is being done during the learning process – with targeted practice to obtain desired levels of performance.

Physical capital generates a significantly higher return on investment than human capital.

Conventional wisdom suggests that substantial, strategic investments in plant, equipment, and technology ensure market competitiveness and higher return-on-investment yields. Yet studies such as those conducted by Huselid (1995) and Huselid and Becker (1997) clearly demonstrate the value of investment in human capital. These findings have been confirmed by additional research such as Welbourne and Andrews (1996) in the area of initial public offerings or Macduffie (1995) in automobile manufacturing. Pfeffer (1998) cites numerous studies from virtually every industrial sector and continent that demonstrate the astonishingly high rates of return on investment

on what he refers to as "high-performance management practices." Those who have long been working in human resources or related fields are generally aware of the high value of an organization's human capital. If they have read any of the careful research work of Nobel prize-winning economists Shultz (1981) or Becker (1993), they are also aware of the incredibly large returns that human capital investment generate at macro economic levels. Edvinsson and Malone (1997), Stewart (1997) and Phillips (1997) have done much to document the return on investment in human and intellectual capital on microeconomic scales. Consider the studies done by Bradley (1996), who examined market-to-book value ratios of US corporations between 1973 and 1993. In 1973, typical market prices for corporations amounted to 82% of book value. (Bear in mind that balance sheets and annual reports provide information on physical assets and only include such intangible assets as patents and brand names.) By 1993, the ratio had shifted to 169% of book value, largely attributed to the rising awareness of the value of intellectual assets. Edvisson and Malone (1997) have estimated that the median book value of US corporations undervalues market worth by about 40%. For knowledge-based companies, the median missing value on the balance sheet is in excess of 100%. Bradley (1996) calculated acquisitions to book value of US companies to be about 4:4:1; for knowledge-based companies, 10+:1. As an example, when IBM purchased Lotus the acquisition price of $3.5 billion exceeded the book value of $230 million by a ratio of 15:2:1 (Oliver, 1995).

Years	Percentage of change
1969-1970	2.6%
1973-1980	1.2%
1980-1990	1.1%
1990-1996	0.98%

Source: Slater & Strawser, 1997

Figure 4. Annual Percentage of Change in Productivity.

For the HPT practitioner, this information, drawn from economic and return-on-investment research, has great significance for performance improvement decision making. It suggests, as key for practice, that the HPT practitioner can and should demonstrate to clients the bottom-line value of investing in human performance improvement initiatives. The research conclusively demonstrates that well-designed human performance systems leverage existing human capital to generate high value compared to cost. This also suggests that HPT practitioners should encourage clients to measure return on investment of HPT interventions in order to enhance their own and HPT's credibility – a payback to the research community.

Technology advances since 1970 have consistently accelerated an overall increase in work productivity.

Until 1998, nothing was further from the truth. Recently, investments in technology have shown significant productivity gains, particularly in the manufacturing sector. However, as Figure 4 illustrates, despite the increased industry investment in information technology of more than 600% between 1978 and 1996, no concurrent gains in productivity had been recorded (Slater & Strawser, 1997).

Levy (1993), in his examination of microcomputer investment projects, attributes this steadily increasing gap between investment and productivity to time required to efficiently utilize new technology (a problem of particular interest to HPT professionals) and time lost from technical problems that arise from newly installed computer hardware and software.

The results of the research and statistical findings comparing enthusiasm for technology

with productivity gains raise cautions for HPT practitioners. Key for practice is that HPT practitioners keep themselves constantly informed of technological advances, ready to accept demonstrable gains in efficiency and effectiveness, but cautious in counseling clients about anticipated performance improvements. The HPT professional must balance technology enthusiasm with respected, credible data that indicate a high probability for replication of improved performance results.

Common sense is a friendly ally of science.

Most research methodology books warn research students that "common sense" presents one of the greatest dangers to scientific truth, that it is frequently an enemy of science. The previous "hit or myth" statements attest to the fact that what seems to make common sense often conflicts with what scientific, objective research has uncovered. Common sense has frequently been a major cause of suppression of scientific truth. Examples of this include the insistence on belief in a heliocentric universe (obviously the sun goes round the Earth), maintenance of practices based on a flat Earth (your eyes clearly provide evidence that the Earth is flat), gender oppression (men are physically bigger and stronger – obvious evidence of superiority), and racial injustice (look at comparisons of intelligence test scores).

Common sense provides subjective meaning to facts (often sparse, poorly defined, and collected in a biased manner). Common sense tends to overgeneralize (from a few isolated incidents to an entire population). It also is driven by logical and illogical extrapolations. As White discovered in his investigations and experimentation on common-sense constructions of causal processes: *"Studies on how humans create cause-effect relationships demonstrate that they tend to draw linear rather than systemic conclusions and are resistant to complex, data-based explanations of phenomena." (1955, p.377)*

An example of this is the increasing concern and fear of crime in America, especially violent youth crime, despite dramatic US statistics that provide hard evidence of significant declines in virtually all forms of crime including violent crimes committed by minors. Another example with serious health implications is the fear of food irradiation despite numerous studies that demonstrate the insignificance of health risks – particularly compared to the documented serious and prevalent effects of, for example, salmonella-related illnesses and deaths, which are largely preventable through irradiation. Musgrave (1993) writes very coherently about the subject of common sense and science.

For HPT practitioners, the key messages for practice that emerge from the research are clear:

– Do not trust common sense – neither one's own nor that of the client.

– Be data driven.

– Be theory driven – theory being the scientific explanation of phenomena backed by solid, empirical research evidence.

There Are So Many More "Myths"…

The purpose of this article has been to encourage HPT practitioners to base their discussion and practice on sound theoretical constructs, scientifically derived evidence, and respectable, well-documented professional precedent. Through a "hit-or-myth" game, this article has introduced some examples of commonly held beliefs that influence HPT practice, but that are not scientifically well founded. What follows are a few more oft-cited

tenets that require greater skepticism and more thorough investigation. All have been either "debunked" or seriously qualified in terms of their overgeneralization.

– Choosing one's own work goals creates greater commitment than if goals are assigned (Clark, 1998; Ford, 1992).

– Working out problems results in better problem solving performance than studying worked-out problems (Paas & Van Merrienboer, 1994).

–Learners learn better when they can explore for themselves (Clark, 1998; Lee & Lee, 1991).

– You can maximize the functioning of a total system by maximizing one of its subsystems, that is, fix the whole organization by fixing one piece of it.

– Size and dominant market share are keys to success (Lucier & Asin, 1994; Pfeffer, 1998).

– Industry matters a great deal – choosing the right competitive niche is critical to success (Rumelt, 1991).

To Summarize

Four simple, yet important messages emerge for the HPT practitioner. They all underscore the necessary, intimate relationship that practice and research must maintain.

1. Research and theory has much to offer to practice. In fact, practice, without a solid research and theory base, becomes little more than "craft." The serious and committed professional has no choice but to consistently seek guidance from research and theory writings as the foundation on which to analyze data and initiate interventions in the workplace.

2. Research and theory have much to learn from practice. As R.E. Clark points out (Sugrue & Stolovitch, 2000), HPT is not a field that should focus its energies on building scientific theory through research. Rather, its inquiry efforts should be directed toward the exploitation of what more fundamental fields discover or what is generated from respectable practice. It should be the questions professional practitioners raise that direct HPT research and theory efforts. HPT is, first and foremost, a *technology*, applying scientific and organized knowledge to practical ends.

3. HPT practice defines those ends, provides initial evidence of possible solutions, and generates theoretical speculations and rigorous inquiry.

HPT prides itself on its scientific heritage in both method and content. Stolovitch and Keeps (1999a) and Foshay et al. (1999) strongly argue that HPT is different from other approaches to performance improvement in that it bases its methods and solutions on scientific, research-based practice and data. Others (e.g. Lindsley, 1999) call this pretension into question, while still stressing that this should be the case. The article reaffirms the need to maintain HPT's technology status and issues a call to arms to ensure that this always be so.

4. We must pay attention to research and theory in our practice and through our practice contribute to research and theory. HPT practitioners are busy, yet vulnerable. Without solid backing, their best efforts can be challenged and dismissed. The price that all practitioners must pay for the continued flourishing success of HPT is the close attention they can give to what research tells them. They must also reinvest, from their own professional work, the discoveries they make so that they can continue to enrich the foundations of the field.

Theory and research add depth and weight to complex issues and serve to nourish successful HPT practice. We conclude by proposing 10 principles and one golden rule for the HPT community – practitioners and

researchers – to live by:

1. An accomplished professional values scientific research and constantly seeks to learn from science.
2. Enthusiasm is no substitute for data.
3. There is a very thin line (if any at all) between exemplary practice and research in HPT.
4. Like research, HPT professional practice is theory driven.
5. HPT requires stronger relationships between client organizations, practitioners, and researchers.
6. HPT discoveries within private organizations must be publicly reported.
7. Business and academia mutually benefit from a close relationship.
8. The rigor of scientific training results in excellent practice.
9. We learn not only by doing, but also by thinking and sharing.
10. By giving freely of our knowledge and discoveries, we reap far more than we sow.

Finally, here is a golden rule for all HPT community members. If you are a practitioner, think of yourself every day as a researcher. If you are a researcher, think of yourself every day as a practitioner. Through respect and adherence to our scientific roots, we can ensure that HPT will maintain its right to endure.

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