Annual Review of Cybertherapy and Telemedicine

Volume 2 Year 2004 ISSN: 1554-8716

Interactive Media in Training and Therapeutic Intervention

Editors:
Brenda K. Wiederhold, PhD, MBA, BCIA
Giuseppe Riva, PhD, MS, MA
Training Brief Intervention with a Virtual Coach and Virtual Patients

Barbara Hayes-Roth, Karen Amano, Rami Saker, Tom Sephton

1Extempo Systems, Inc., Redwood City, CA, USA

Abstract: Alcohol and substance abuse is the number one mental health problem in America as well as a major health problem. Although brief interventions during primary care visits can be effective, clinicians usually do not act on signs of alcohol abuse—often because they do not know how to intervene. Clinicians need training in brief intervention techniques, but this is impractical due to the large number of clinicians, the high costs, and the daunting logistics of the only effective training method currently available—practice with standardized patients. To address this need, we developed STAR™ Workshop, an online training workshop incorporating a virtual coach and virtual standardized patients. The STAR coach motivates and teaches an evidence-based brief intervention protocol. STAR virtual patients provide practice and intrinsic reinforcement. After each practice session, the coach offers additional feedback and any needed remediation. We comparatively evaluated STAR Workshop against a self-paced E-Book covering the same content and a no-training Control, with medical and nursing students as subjects. Students trained with STAR Workshop substantially outperformed subjects in the other conditions, achieving high scores on self-assessments of their own intervention skills and intentions to intervene, as well as on objective assessments of their intervention skills, based on both short-answer probes and recorded interventions with live standardized patients. Thus, STAR Workshop provides a scalable, affordable, and effective approach to training brief intervention skill in alcohol abuse.

INTRODUCTION

Alcohol and substance abuse is the number one mental health problem in America and a major health problem, impacting individuals, families, friends, co-workers, employers, and communities. Brief interventions administered during routine clinic visits have been shown to be effective in reducing the health risks and social costs of alcohol abuse.1-4 Primary care settings are ideally suited for intervention, as patients tend to visit them more often than medical specialty settings.5 Brief interventions are also attractive for their simplicity and low cost. Following a simple 10-15 minute interview protocol, non-specialists can effectively administer brief interventions.3

Unfortunately, few providers routinely screen patients or intervene in alcohol abuse. Fleming26 reports 20% screening rates during hospital admissions, citing insufficient training as the primary reason: “Asking patients about sensitive life-style issues, such as alcohol use, requires strong communication skills. Many physicians have not received training in this area.” The Center for Addiction and Substance Abuse (CASA) finds that physicians miss signs of alcohol abuse 94% of the time and 11% of patients report physicians who were aware of their addictions but did nothing.7 Calling alcohol and substance abuse America’s #1 disease, Joseph Califano, President of CASA and former Secretary of HEW, said, “Substance abuse is an elephant in the examining room. Doctors may simply be embarrassed to ask the key questions. They don’t want to anger their patients. They think patients will lie about this... Medical schools and other education programs for physicians need to provide more training on how to spot and deal with substance abuse.” A Commonwealth report on medical education8 concurs: “Many young physicians do not feel confident counseling patients on such subjects as smoking, weight reduction, safe sex practices, domestic violence, and drug and alcohol use. To prepare students for the challenges facing health care in the 21st century, academic health centers must place more emphasis on skills not traditionally taught in medical schools. Physicians need training to address the behaviors and social circumstances at the root of many health care issues.”
For inter-personal skills such as those involved in brief intervention, role-playing has long been recognized as the training method of choice. Roughly 80% of medical training centers now integrate role-play with “standardized patients” as part of a problem-based medical curriculum. More specifically, Fleming suggests that “Role playing can be an invaluable way to teach physicians how to become more comfortable with alcohol screening questions and interviewing techniques allowing them to rehearse their skills before they interact with their patients. Because nothing can substitute for practice and repetitions, role playing can build a physician's confidence in his or her alcohol-screening skills.”

On the other hand, cost and logistics make this approach impractical. It takes 10-30 times as many teaching professionals to move from a traditional, lecture-based model to small group instruction of 5-10 students in problem-based curricula. Many smaller community teaching hospitals do not have the resources to implement problem-based curricula and few teachers have expertise in conducting small groups. The use of standardized patients is also expensive. The Uniformed Services University, one of the largest military medical training centers in the country, reports annual operating costs for its Medical Simulation center of $1.3 million with $300,000 for standardized patients and $125,000 in training costs. The American Medical Association estimates the cost of clinical skills testing with standardized patients as high as $1,700 per test. Similarly, test preparation companies are charging approximately $1,000 per day for small group workshops with standardized patients.

Moreover, even live workshops and role-playing appears to have limited efficacy. In our own studies of inter-personal skills for management-staff communication (which are in many ways analogous to brief intervention skills), live training workshops featuring professional instructors and peer role-players produced high learner satisfaction and self-reports of skills improvement, but little or no improvement on objective performance measures. Similarly, in several studies of motivational interviewing for alcohol abuse, live training workshops produced self-reports of skills improvement up to 4 months later, but only modest improvements (too small to affect client response) in objective observations of interviewing performance.

We believe that these disappointing results reflect common misconceptions about the nature of sophisticated inter-personal skills and the training experiences required for individuals to master such skills and incorporate them into everyday practice. First, many people underestimate the high skill levels required for efficacy in sensitive inter-personal interactions and the amounts of practice and coaching required to attain skill levels. Compounding this misconception, many people suffer “cognitive illusions” in which they overestimate the efficacy of elementary training experiences and the skills they engender. Third, instructors and standardized patients vary in their own expertise and consistency. After all, they are only human! In sum, we believe that even expert researchers and training providers err in attempting to achieve ambitious training objectives—mastery of sophisticated inter-personal skills—by providing an insufficient amount of insufficiently challenging, training experience of variable quality.

To address the need for effective, efficient, affordable, scalable training in brief intervention skills, we developed the STAR™ Workshop for Brief Intervention in Alcohol Abuse. Following the literature on enhancing human performance, STAR Workshop implements a Guided Mastery™ pedagogical strategy, featuring a virtual coach and several virtual standardized patients (VSPs), all built on interactive character technology. Figure 1 displays excerpts from a training session in STAR Workshop.

As with live workshops with standardized patients, STAR Workshop provides expert instruction, authentic practice, and detailed feedback. In contrast to live workshops, STAR’s Guided Mastery strategy provides as much practice and as much coaching as each individual learner requires, systematic guidance to master the target skills, and individually optimized learning paths. Thus, in addition to being affordable and scalable, we hypothesize that STAR Workshop will be uniquely effective and efficient in its training of brief intervention skills. The present study is designed to evaluate that hypothesis.
MATERIALS AND METHODS

Target Protocol

To provide a training target for our study, we developed a brief intervention protocol called Engage for Change™ (E4C™). The E4C protocol adapts the evidence-based techniques of motivational interviewing. Given the practical needs of a large and diverse population of primary-care clinicians, and the operational requirements of automating the training process, the E4C protocol was constrained to be general, brief, memorable, teachable, and verifiable. At the most general level, the E4C protocol is as follows:

A. Inform the patient of health risks:
1. Raise the topic of alcohol consumption in a general health context.
2. Inform the patient of his or her specific health risks associated with alcohol.

B. Acknowledge the patient's point of view:
3. Invite the patient to express his or her concerns about health consequences of alcohol.
4. Accept the patient's stated concerns.

C. Encourage the patient to make a change.
5. Invite the patient to make an appropriate change step.
6. Ask the patient to commit to make the change step.

Motivational interviewing was developed originally as a compassionate alternative to confrontational methods for treating addiction. Its efficacy is supported by many studies, including alcohol abuse studies intervention. Thus, the E4C protocol should be similarly effective for a brief intervention regarding alcohol abuse. However, verification of its clinical efficacy is beyond the scope of this study.

Instructional Content

We created 41 Web pages containing 23 pages of instructional content for use with all learners; 12 pages of coaching content to be used with individual learners at the coach's discretion; and 6 pages for displaying VSP medical histories and role-play scores.

Virtual Coach

We created a virtual coach named “Harmony.” She has an animated embodiment with approximately 25 gestures and facial expressions, which she uses to complement her dialogue. She delivers her dialogue in a synthesized voice and typed speech bubbles, personalizing it to call the student by name, quoting segments of the student's role play conversations with VSPs, etc. Harmony presents 80 instructional topics, with approximately 100 associated lines of instructional dialog. She also has about 300 lines of feedback dialogue which she selects and instantiates with student-specific information. She has about 100 lines of coaching dialogue, which she selects based on student performance. She has 124 preconditions, which she uses to select dialogue and actions. Harmony currently accepts only point-and-click input from students wishing to continue or quit.

Virtual Standardized Patients

We created three VSPs—Lee, Nina, and Ed—differing in gender, age, culture, personality, health scenario, resistance, and referral needs. Each VSP has a photographic embodiment (created with actors), with approximately 25 gestures and facial expressions, which he or she uses to complement dialogue. VSPs deliver their dialogue in recorded human voice (created by actors) and typed speech bubbles. They accept typed natural language input from students. Each VSP has 12 conversational contexts, with about 200 lines of dialogue and two-six alternate wordings for each line. They recognize 80 sets of semantically equivalent student inputs, with 8-20,000 alternate wordings accepted for each one. VSPs have 75 preconditions, which they use to select dialogue, gestures, or a new conversation context. They have 18 moods (e.g., confident, unconfident, edgy, defensive, comfortable), which are influenced by their interaction with a student and manifest in the selection of dialogue, gesture, and context.

Training Conditions

Our study had three training conditions: STAR Workshop, E-Book, and Control. STAR Workshop is described above and incorporates all instructional content, the virtual coach, and the
four VSPs. For E-Book, we created a self-paced course, with Web pages incorporating all instructional content created for STAR Workshop, plus all of the STAR Coach’s instructional dialogue. Students could access the E-Book like a conventional e-learning application, choosing whether or not to follow the recommended page sequence, how much time to spend on each page, etc. The Control condition had no training.

Subjects

31 subjects included medical students from Stanford University and nursing students from the University of San Francisco and San Jose State University. We assigned subjects to training conditions semi-randomly, balancing education, age, gender, ethnicity, and pre-training assessments of attitudes and skills (discussed below). We did not predict or find any effects of these variables and do not refer to them further. Subjects were paid $100 for their participation.

Procedure

The following procedure was applied for all subjects:

- **Pre-Training Assessment** – Self-reports of attitudes and short-answer skills probes;
  - Training – STAR Workshop, E-Book, or Control
- **Post-Training Assessment** – Self-reports of attitudes and short-answer skills probes;
- **Two Week Post-Training Retention Interval**
- **Post-Delay Intervention with a Live Standardized Patient (LSP) – Telephone interview;**
- **Post-Delay Assessment** – Self-reports of attitudes and short-answer skills probes.

Attitude Assessments

Subjects used 5-point Likert scales to report their attitudes toward these statements: 1. The E4C protocol is effective. 2. The E4C protocol is practical. 3. My training method was effective. 4. I am confident in my brief intervention skills. 5. I plan to intervene with patients who show signs of alcohol abuse. For STAR and E-Book subjects, pre-training assessments included statements 4 and 5; post-training and post-delay assessments contained statements 1-4. For Control subjects, all assessments included only statements 4 and 5.

Efficacy–Skills Probes

Subjects’ skills were assessed with short-answer probes, representing the 6 steps in the E4C protocol, on all 3 assessments. Responses were scored 0-3 points: correct step, correct step in context, no errors (e.g., patronize, contradict, advocate change).

Sample Basic Probe Item: Troy, 43, an attorney, is at your clinic to check his recovery from a broken collarbone suffered in a car crash. On his medical history, he reports that he consumes 30 drinks of alcohol per week. He also reports frequent insomnia and gastritis, which you think may be related to his alcohol consumption. Troy says: “The shoulder’s much better. We’re done for today, right?” What do you say?

**Correct response step:** Step 1. Raise the topic of alcohol consumption in a health context.

Sample correct responses:

“I would like to spend a few minutes explaining how drinking may be affecting your health.”

“Troy, I want to discuss the role of alcohol as a contributing factor to insomnia.”

“Let’s talk about how alcohol consumption may be contributing to your gastritis.”

Note: Besides basic probes, our study included easier cued probes and more difficult open probes. Since all probes showed comparable effects, we discuss only basic probes here.

Transfer of Retained Skills—Live Intervention

Subjects’ skills were assessed in performance of telephone interventions with a live standardized patient (LSP), conducted after the 2-week post-training retention interval. Subjects received the case history below and then were given 10 minutes to conduct the intervention. The recorded intervention was scored 0-18 points, with 0-3 points (correct step, correct step in context, no errors) for each step in the
E4C protocol.

The LSP Case History. Morgan, 51, a recently divorced attorney and mother of 2, is at the clinic for an allergy shot. Her previous record indicates low-normal blood pressure and overall good health. On exam, her blood pressure is significantly higher than on previous exams. She has a slight cough today and reports that she is recovering from a cold. On her medical history, she reports drinking 2-3 glasses of wine daily. She has occasional headaches and moderate stress. According to NIAAA guidelines, a woman may be at risk for alcohol-related problems if she consumes more than 7 alcoholic drinks a week or more than 3 drinks a day. High blood pressure and headaches are both associated with heavy drinking. You are concerned that Morgan’s alcohol use may be contributing to these conditions and that she may be headed for future health problems. You suspect that her drinking may be having negative impacts on other areas of her life, as well. An appropriate referral for Morgan might be to a behavioral health case manager to develop a reduction plan.

Scoring and Data Analysis

Two judges blindly and independently scored responses for skills probes and live interventions. An independent 3rd person combined judges’ scores and entered them in spreadsheets along with self-report attitudinal data, key demographic data, and learning path data automatically recorded by STAR and e-Book. Summary statistics were computed in these spreadsheets. We omit conventional statistics; these would be redundant and obvious, given the large and consistent differences observed.

RESULTS

Verifiable Individual Progress and Individually Optimized Training with STAR Workshop

100% of subjects in the STAR Workshop condition mastered the E4C protocol. Subjects displayed individual progress in performance improvements with successive VSPs: increasing initial role-play scores (means = 4, 14, 17 out of a perfect score of 18), decreasing number of role-plays required for mastery (means = 6, 3, 2), and a decreasing number of step-coaching events required for mastery (means = 14.3, 5.7, 2.8). In addition, 100% of STAR subjects were guided along unique learning paths, optimizing the sequence, duration, and content of instruction, role-play, feedback, and coaching, based on individual progress and specific individual behaviors during role-play. As a consequence, subjects varied widely in the number of minutes they spent on: instruction (range = 15-23), role-play (range = 24-105), and coaching (range = 28-131).

Comparison of Immediate Impact and Efficacy of STAR, E-Book, and Control

STAR and E-Book produced comparable positive immediate impact on subjects’ attitudes. Subjects judged the E4C protocol effective (mean = 5 vs. 5) and practical (mean = 4 vs. 4). They gave positive ratings to their training (mean = 4 vs. 4), their intervention skills (mean = 4.5 vs. 4.25) and their intentions to intervene with patients showing signs of abuse (mean = 5 vs. 4).

However, E-Book subjects performed only slightly better than Control (no training) subjects on skill probes of immediate efficacy. 72% vs. 62% of subjects improved over pre-training skills, achieving 22% vs. 10% of the maximum possible improvement. Subjects averaged 61% vs. 50% correct responses on post-training assessment, with no subjects in either group scoring >90%. Thus, E-Book subjects’ positive self-assessments reflected over-confidence.

By contrast, STAR subjects performed substantially better than E-Book and Control subjects, and at a high absolute level on skills probes of immediate efficacy. 100% of STAR subjects improved over pre-training skills, achieving 78% of the maximum possible improvement. STAR subjects averaged 89% correct responses on post-training assessment, with 46% scoring >90%. Thus STAR subjects’ performance validated their positive self-assessments.

Comparison of Retained Impact and Efficacy of STAR, E-Book, and Control

Results for retained impact and efficacy following the two-week retention interval were similar
to but more exaggerated than results for immediate impact and efficacy.

Again, STAR and E-Book produced comparable positive retained impact on subjects’ attitudes, identical to the immediate data, except E-Book subjects reduced their mean assessment of the effectiveness of the E4C protocol from 5 to 4.

On skill probes of retained efficacy, E-Book subjects fell even closer to Control subjects, whose scores remained constant. 64% vs. 62% of subjects improved over pre-training skills, achieving 11% vs. 10% of the maximum possible improvement. Subjects averaged 56% vs. 50% correct responses on delayed skills probes, with no subjects in either group scoring >90%. Thus, after a two-week retention interval, training with E-Book was no better than no training at all.

Again by contrast, STAR subjects performed substantially better than E-Book and Control subjects, on skills probes of retained efficacy at a high absolute level. 100% of STAR subjects improved over pre-training skills, achieving 76% of the maximum possible improvement. STAR subjects averaged 89% correct responses on delayed skills probes, with 55% scoring >90%. Thus STAR subjects retained their excellent skills over the two-week retention interval.

Comparison of Transfer of Retained Skills to Live Intervention

On transfer to live intervention, E-Book scores were similar to Control scores. Subjects in both groups averaged 50% correct, with no subjects in either group scoring >90%. However, only 18% of E-Book subjects made no extraneous errors, compared to 38% of Control subjects. Again, training with E-Book is no better than no training at all.

STAR subjects performed substantially better than E-Book and Control subjects, on transfer to live intervention at a high absolute level. STAR subjects averaged 94% correct performance, with 55% scoring >90%, and 82% making no extraneous errors. In fact, these scores are at least as good as the scores on the immediate and delayed skills probes. Thus STAR Workshop prepared subjects to perform quite well in live interventions two weeks after training.

DISCUSSION

Results of the present study demonstrate the efficacy of STAR Workshop for training clinicians in the E4C protocol for brief intervention in alcohol abuse. STAR subjects performed extremely well on both immediate and delayed skills probes and on the critical test of intervention with a live standardized patient. In addition, STAR subjects showed 100% uniqueness and broad variability of learning paths, tied to individual progress on learning objectives. Thus, the results confirm our hypothesis that STAR Workshop would provide effective and efficient training in brief intervention skills.

Results of the study also indicate that training with E-Book self-paced learning may induce cognitive illusions in which learners overestimate the efficacy of their training and their own competence. Although E-Book subjects reported high confidence, comparable to STAR subjects, their performance was poor and comparable to Control subjects on all immediate and delayed skills probes, as well as in an intervention with a live standardized patient.

Although this study did not include a live training condition, it is noteworthy that STAR subjects demonstrated very strong intervention skills on all assessments, especially in their interventions with a live standardized patient. With enhancements to STAR Workshop—for example, practice with a greater variety of VSPs—performance will approach a ceiling, leaving the possibility for only small improvements, at best, in live training. Given the high cost and daunting logistics of live training, STAR Workshop may offer an extremely attractive alternative, matching the efficacy of live training at a lower cost. While further study is required to clarify these cost-benefit trade-offs, the prospect of a Pareto optimal approach is tantalizing.

It also is worth noting that the E4C protocol is a variable in our study and in STAR Workshop. Although prior research on motivational interviewing suggests that E4C should be clinically effective for brief intervention in alcohol abuse, it is quite possible that new research might sug-
gest improvements to the protocol or an alternate more effective protocol. STAR Workshop can be applied to teach any such new or modified protocol. In fact, STAR Workshop can be an important tool supporting large-scale clinical trials of alternative intervention protocols by providing an efficient and effective means of verifiably training large numbers of clinicians to reliably follow experimental protocols.

In sum, the present findings provide a promising foundation for the development of a comprehensive program for training brief interventions in alcohol abuse and delivering the program to a broad range of primary-care clinicians in a form that is practical, scalable, and affordable. This would enable a larger number of clinicians to perform more effective interventions with a larger number and diversity of patients, at earlier, more treatable disease stages. This, in turn, would enhance immediate and life-long patient health while reducing immediate and life-long costs of health care.

Success with this important application would also lay the groundwork for developing STAR Workshops to train effective intervention protocols for drug abuse, obesity, eating disorders, exercise, safe-sex, diabetes management, asthma management, and other conditions where health outcomes and costs depend on the clinician’s skills in facilitating changes in patient behavior.
Kay (pseudonym), a Stanford medical student, is learning the E4C protocol in STAR Workshop. Harmony, the STAR Coach, explains, motivates, and illustrates each step in the protocol.

Lee, a VSP, gives Kay authentic practice, conversing with her in natural language, complemented by appropriate facial expressions, body language, and emotional dynamics. Lee's life-like behavior provides intrinsic reinforcement of Kay's performance. Even smart students like Kay make errors on early practice.

Harmony scores Kay's role-play performance. She offers detailed, personalized feedback, calling Kay by name and quoting segments of her dialogue with Lee.

Harmony provides explicit, systematic reinforcement of strengths and weaknesses in Kay's intervention with Lee. For each step in the E4C protocol, Harmony explains what Lee did, whether or not it was correct, and what its consequences were.

**Figure 1. Illustrative Excerpts from a Training Session in STAR Workshop.**

Kay, when inviting your patient to express concerns, try to cultivate an atmosphere of trust and the patient’s sense of autonomy. Be sure to ask an open-ended question that invites more than a yes or no answer. A patient who can speak freely may reveal a lot about motivation and readiness to change.

**Step 3. Invite the patient to express concerns...**  
by asking open-ended questions that relate drinking behavior to health, work, social, or family consequences.  
Example:  
"How do you think your use of alcohol may be affecting your health?"

Kay, that didn’t go very well, did it? Don’t worry. You can try again in a moment. Let’s review.

You did a good job raising the topic of Lee’s drinking when you said, “Lee, I would like to talk about how alcohol is affecting your health.” By raising the topic in a neutral health context, you made Lee feel comfortable and willing to discuss his drinking. Good work, Kay.

Next, you should have informed Lee of his specific health risks associated with drinking. Instead, you suggested that Lee change his behavior, when you said, “You need to reduce your drinking, Lee.” I know this was good medical advice, Kay. However, advocating change prematurely actually made Lee more resistant. … [etc.]
Harmony gives Kay remedial instruction only for those protocol steps on which she made errors in her most recent role-play practice.

Harmony suggests, motivates, and illustrates substitute behaviors for Kay to try in her next role-play practice.

Kay masters the E4C protocol on her 5th role-play with Lee.

Note that VSP Lee provides authentic repeat practice. He responds appropriately to changes in Kay’s behavior and introduces normal variability in his own dialogue. Thus, Kay cannot simply remember a correct “script” for intervening with Lee. She must listen and engage expertly with Lee on every practice.

Coach Harmony congratulates Kay on her mastery of the E4C protocol with Lee. She systematically reinforces every element of Kay’s correct performance.

Next, Harmony will introduce VSP Nina and, later, VSP Ed. With each of them, she will guide Kay through the same individualized process of practice-feedback-coaching, leading her to mastery of the E4C protocol.

Kay, informing your patient of risks associated with alcohol consumption is one of your important functions. Remember to tell your patient how drinking impacts his or her specific health conditions. Your message will most likely be heard if you stick to the facts and refrain from criticizing your patient’s current drinking behavior or advising a particular course of action.

Kay’s 5th role play with VSP Lee is perfect

Lee: Well, I’m relieved there’s no fracture.
Kay: Let’s discuss the impact of alcohol on your health.
Lee: OK, fine.
Kay: Your alcohol consumption may be negatively affecting your ulcers, blood pressure, and sleep.
Lee: Well, that’s certainly one of the downsides.
Kay: Lee, what effect do you think alcohol has on your health?
Lee: I hate having the ulcer! Drunks have ulcers. Believe me, I’m not getting any more drunk diseases!
Kay: You’re worried that drinking is causing your ulcers.
Lee: To be honest, it’s tougher to quit than I thought it would be.
Kay: I know a counselor that you might be interested in seeing. She’s helped other young professionals like you change their drinking patterns.
Lee: Interesting.
Kay: Will you follow through with this referral?
Lee: All right. I’m going to do it. OK. Bye now. And thanks.

Excellent Kay! You’ve mastered the role play with Lee. Let’s review.

Another good start for you, Kay. You said “Let’s discuss the impact of alcohol on your health.” By introducing the topic in a health context, you made Lee feel comfortable and willing to discuss his alcohol consumption. Kay, this is your best score so far on step 2. You informed Lee of his specific health risks when you said, “Your alcohol consumption may be negatively affecting your ulcers, blood pressure, and sleep.” Again, Kay, you did a good job inviting … [etc.]
ACKNOWLEDGEMENTS

We gratefully acknowledge expert consultation on design of the Engage for Change™ protocol and specification of practice cases for VSPs from Dr. Nancy Handmaker, of the University of New Mexico, and Dr. Louis Moffett and Dr. Matthew Cordoba, of the Palo Alto Veterans Administration Medical Center. This project was funded by grant 1 R43 AA014306-01 from the NIAAA. Technology development was funded by grant 70NANB9H3024 from the NIST ATP.

REFERENCES


Submitted: January 5, 2004
Accepted: April 14, 2004

CONTACT:

Barbara Hayes-Roth
Extempo Systems, Inc.
643 Bair Island Road, Suite 302
Redwood City, CA 94301
Ph: (650) 701-2015
Fax: (650) 701-2099
E-mail: bhr@extempo.com