

Effects of Computer-Based Cognitive Restructuring on Rationally Mediated Self-Esteem

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Fifty-six 11th- and 12th-grade students with below-average self-esteem were classified by gender and randomly assigned to either computer-based cognitive restructuring or a relaxation-training control condition. The computer intervention (laden with multimedia features such as color video clips, stereo music, digitized speech, and engaging graphics) targeted irrational beliefs linked in previous research to low self-esteem. Participants were assessed repeatedly as they progressed through the program; depending on the tenacity of each belief held, the program provided a variety of cognitive restructuring responses. Multivariate and univariate effects on four measures of rationality and self-esteem favored computer-based cognitive restructuring.

Previous *ex post facto* research has established that specific irrational beliefs are differentially related to various psychological problems (e.g., Cash, 1984; Deffenbacher, Zwemer, Whisman, Hill, & Sloan, 1986). For example, certain subscales of the Irrational Beliefs Test (IBT; Jones, 1969) are consistently predictive of low self-esteem, whereas other subscales are not (Daly & Burton, 1983; Erickson, Horan, & Hackett, 1991; McLennan, 1987; Nielsen et al., in press). Results of additional experimental research by Lamke, Lujan, and Showalter (1988) and Warren, McLellarn, and Ponzoha (1988) suggested a causal connection between general cognitive restructuring and increased self-esteem. Both lines of research converged on the possibility that a cognitive restructuring protocol addressing only the specific irrational correlates of low self-esteem would offer a reasonably effective intervention at a minimal cost in time.

In studies of the relation between specific irrationality and low self-esteem (Daly & Burton, 1983; Erickson et al., 1991; McLennan, 1987; & Nielsen et al., in press), multiple regression equations have identified demand for approval, anxious overconcern, high self-expectations, problem avoidance, and helplessness as predictors; moreover, simple correlations have implicated emotional irresponsibility and frustration reactivity as well. Interestingly, these seven irrational beliefs involve faulty internal attributions about one's competency: such attributions have been shown to be a major precursor to depression and a host of other clinical problems (e.g., Abramson, Seligman, & Teasdale, 1978).

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The remaining scales of the IBT pertain to external attributions and have not been found to covary with self-esteem.

These seven irrational beliefs fit neatly into a conceptual framework for the promotion of self-esteem offered by Pope, McHale, and Craighead (1988). According to their model, four central areas heavily influence children's self-esteem: peer relationships, academic ability, role in family, and body image. Cognitive restructuring intervention protocols can readily be developed to confront the presence of irrational beliefs in each of these applied areas.

Traditional intervention programs usually require all clients to progress through various lessons or modules in linear order, regardless of the relevance of such materials to their particular experience of the clinical problem. For example, stimulus-control applications to obesity inevitably involve training objectives for everyone such as setting the fork down between bites; even clients who display normatively low consumption rates are taught to slow down their eating pace. Similarly, nonassertive clients in standardized treatment programs can expect to receive full protocols of both cognitive restructuring and behavioral rehearsal even when their particular problem derives from circumscribed areas in only one of these domains. In contrast to traditional intervention modes, the computer is capable of assessing the unique pattern of knowledge and skill deficits inherent in each individual and delivering appropriate intervention components to only the areas in need of remediation.

Desktop computer applications have grown exponentially in speed and capability over the past decade. Treatments are no longer restricted to text presentations on monochrome screens; rather, multimedia features such as color video clips, stereo music, digitized speech, and intense graphics have become de rigueur. Not only are such enhancements more interesting and engaging (which suggests applicability to a much wider audience), recent reviews have indicated that they also increase learning speed and comprehension (DeBloois, 1988; Ives, 1992).

Harris-Bowlsbey (1984, p. 11) foretold that rational-emotive techniques would be particularly suited to the computer, which can serve as a "forceful teacher" in actively

persuading clients to change irrational, problem-causing beliefs. We add that the extraordinary level of interactivity permitted by current authoring software is highly relevant to fulfilling Harris-Bowlsbey's prophesy. Here the flow of the intervention is guided by the responses of the client; branching to new topics, recycling when mastery has not been achieved, and customizing feedback with regard to timing and content are all involved (Grant, McAvoy, & Keenan, 1982; Hannafin, 1991; Park & Gittelman, 1992). We evaluated whether a computer-based cognitive restructuring program addressing a focused array of irrational covariates could enhance self-esteem by assessing and altering individualized patterns of irrational thinking.

Method

Participants

One hundred eight 11th- and 12th-grade students enrolled in four high school introductory psychology classes obtained parental permission and gave their own consent to participate. Their ages ranged from 16 to 19 years. Three quarters of the sample were White; Hispanics ($\approx 14\%$) constituted the largest minority. Although all students volunteered and believed themselves to be participants in the study, pretest scores on the self-esteem measures were pooled separately for male and female students, and only those in the bottom half of the gender distributions in each class (28 male and 28 female students) were selected and randomly assigned to either the experimental or control treatments. This subterfuge was necessary to preclude the possibility that participants might be publicly labeled as having low self-esteem. Students not selected received the control treatment, but their data were discarded.

Measures

Rationality measures. The IBT (Jones, 1969) consists of 100 Likert-type items arrayed on 10 subscales corresponding to 10 of Ellis's (1962) list of irrational beliefs. Sample items include "It is important to me that others approve of me" and "I hate to fail at anything."

In view of Nielsen et al.'s (in press) data suggesting that changes on certain scales readily generalize to others and the fact that our experimental treatment addressed 7 of the 10 irrational beliefs, we focused only on total scores and found an internal consistency reliability coefficient of .81 from the combined pretest results for experimental and control participants. The IBT served as a check on experimental construct validity as well as an outcome measure per se, because the logic of our hypotheses dictated that changes in self-esteem would occur via improvements in rational thinking. If the experimental treatment increased self-esteem without enhancing rationality, the construct validity of our experiment would be challenged (see Cook & Campbell, 1979; Horan, 1995).

Self-esteem measures. Three self-report measures were employed: (a) the Janis-Field Feelings of Inadequacy Scale (Eagly, 1967), which contains 20 items on 5-point Likert scales (e.g., "How often do you have the feeling there is nothing you can do well?"); (b) the Rosenberg Self-Esteem Scale (Rosenberg, 1965), which consists of 10 items on 4-point Likert scales (e.g., "At times I think I am no good at all"); and (c) the Piers-Harris Children's Self-Concept Scale (Piers, 1984), which is an 80-item inventory calling for *yes* or *no* responses to items such as "I can be trusted"

and provides global and specific measures of self-esteem (however, only global scores were used). We calculated internal consistency reliability coefficients from the combined pretest results from experimental and control participants in our study: alpha coefficients of .70, .61, and .80 were found for the Janis-Field, Rosenberg, and Piers-Harris instruments, respectively.

Procedure

Participants completed all outcome measures 1 week before and within 1 week after finishing treatment. All students were told that they would receive either of two programs of equivalent relevance to be conducted on 2 consecutive school days during the normal 50-min class period. The amounts of time allocated for the experimental and control conditions were equal; however, the individualized nature of the experimental treatment permitted some students to finish earlier than others.

The experimental students received the intervention on a bank of seven IBM clones, each having 486 DX or Pentium processors, eight megabytes of RAM, and sufficient hard drive space to contain the intervention program, which in compressed form occupied 121 megabytes. To minimize distraction, the audio portions of the intervention were delivered through earphones.

The experimental intervention was developed with the use of Authorware, Version 2 (1995), a multimedia programming framework that organized the components of 13 separate cognitive restructuring modules focused on specific irrational beliefs. The program was divided in such a way that seven modules were presented in the first treatment session and six in the second. Each module began with a video clip depicting a student of similar age, varying gender, and varying ethnicity, experiencing a variety of emotions such as frustration from difficult homework assignments and social rejection by peers. For example, the opening module focused on the irrational belief "Demand for Approval" in Pope et al.'s (1988) context of body image. The voice-over accompanying a video of a young woman on the screen said,

"You know what happened today? One of my friends told me I looked awful. Man, that makes me really feel worthless. Until everyone likes how I look, I guess I am going to be miserable. Do you ever feel this way?"

Each of the modules then offered the students three buttons, to be activated by a mouse click, labeled *Usually*, *Sometimes*, or *Never*. If the students chose *Never*, an attractive "Yahoo!" graphic appeared on screen, accompanied by applause and a confirming sample of rational self-talk that they were probably engaging in. They then moved on to the next module.

If the students chose either the *Usually* or *Sometimes* button, however, they received cognitive restructuring dialogs that challenged the irrational basis of their thinking and offered more rational perspectives. Responses to prompts such as "Is this becoming more clear?" indicated whether additional challenges were appropriate. The students were then cued to think about what might be a more rational way to view the situation and, in similar interactive manner, were provided with additional examples of rational thought. Music, engaging graphics, and opportunities to recycle through the instructional materials of each module were interspersed throughout the program. Complete scripts for the 13 modules indicating all branching permutations are available on the Internet at the corresponding author's Website.

Students in the control group were trained in relaxation exercises via audiotapes narrated by Arnold Lazarus (1970). The second and third tapes, entitled "Daily Living: Coping with Tensions and Anxieties—Relaxation Exercises I and II" were selected

from this package of five cassettes and administered on consecutive days.

Results

Preliminary Analyses

Attrition. Of the original 28 participants assigned to the experimental treatment, 2 were absent from a session, and their data were dropped from the analyses. Replacements were selected from an alternative list composed of other students who were in the bottom half of the self-esteem distribution. A third alternative was added when one experimental participant quickly advanced through the program, leaving an unoccupied computer. Of the original 28 control participants, 2 were absent from a session and were not replaced. Final analyses thus included data from 29 experimental and 26 control participants.

Correlational analyses. We noted pretest intercorrelations between the IBT and the three self-esteem measures of $-.59$, $-.44$, and $-.51$ for the Janis-Field, Rosenberg, and Piers-Harris instruments, respectively. Moreover, the Janis-Field data correlated $.75$ with the Rosenberg data and $.68$ with the Piers-Harris data, and the latter two measures yielded a pretest correlation of $.70$, all of which suggest reasonable concurrent validity for the self-esteem devices.

Power analysis. A statistical power analysis adapted from Stevens (1986) indicated sufficient strength (i.e., $>.8$) to detect large effects at an alpha level of $.05$.

Treatment Effects

In Table 1 we present the means and standard deviations for experimental and control participants on both testing

occasions; these means are collapsed over gender except on one variable, for which an interaction involving gender and treatment was found. An initial $2 \times 2 \times 2$ (Treatment \times Gender \times Repeated Measures) multivariate analysis of variance (MANOVA) on the four outcome measures (IBT, Janis-Field, Rosenberg, and Piers-Harris) yielded a main effect for repeated measures, $F(7, 45) = 2.230$, $p < .001$, and a double interaction involving treatment and repeated measures, $F(7, 45) = 2.23$, $p = .049$. No other multivariate main or interaction effects emerged.

Follow-up univariate analyses of variance (ANOVAs) of the multivariate interaction produced a Treatment \times Repeated Measures interaction on the IBT, $F(1, 51) = 4.80$, $p = .033$, and on the Janis-Field measure, $F(1, 51) = 10.35$, $p = .002$, and a Treatment \times Gender \times Repeated Measures interaction on the Rosenberg measure, $F(1, 51) = 6.78$, $p = .012$. Whereas participants of both genders receiving the experimental intervention showed improvement in rational thinking on the IBT and in self-esteem on the Janis-Field measure, Tukey post hoc t tests indicated that only male students in the experimental condition (and female students in the control condition) showed gains on the Rosenberg measure. No univariate interactions appeared on the Piers-Harris measure, and because the triple interaction on the Rosenberg measure was not preceded by a similar significant multivariate effect, its interpretation should be considered exploratory (see Behrens & Smith, in press).

Follow-up univariate ANOVAs of the multivariate repeated-measures main effect indicated that experimental and control participants collectively showed improvement over time on all measures of rationality and self-esteem: IBT, $F(1, 51) = 24.08$, $p < .0001$; Janis-Field, $F(1, 51) = 9.09$, $p = .004$; Rosenberg, $F(1, 51) = 11.23$, $p = .002$; and Piers-Harris, $F(1, 51) = 5.73$, $p = .02$. However, because

Table 1
Means and Standard Deviations for Experimental and Control Groups on Both Testing Occasions

Variable	Experimental		Control	
	Pretest	Posttest	Pretest	Posttest
Irrational Beliefs Test ^a				
<i>M</i>	305.83	289.34	297.38	290.65
<i>SD</i>	26.79	32.87	29.64	26.60
Janis-Field Feelings of Inadequacy Scale ^b				
<i>M</i>	64.55	72.03	71.04	70.88
<i>SD</i>	12.05	13.60	11.12	11.16
Rosenberg Self-Esteem Scale ^b				
Male students				
<i>M</i>	28.07	32.14	30.50	30.00
<i>SD</i>	5.65	6.09	4.54	4.47
Female students				
<i>M</i>	28.60	29.93	29.21	31.79
<i>SD</i>	3.56	5.57	4.49	4.32
Piers-Harris Children's Self-Concept Scale ^b				
<i>M</i>	53.52	56.28	55.65	58.23
<i>SD</i>	11.62	14.48	12.15	11.73

^a Higher scores reflect greater irrationality. ^b Higher scores reflect greater self-esteem.

participants were selected on the basis of low self-esteem scores, a regression artifact or, indeed, any of Campbell and Stanley's (1966) classic sources of internal invalidity loom as rival hypotheses to a conclusion that both intervention conditions were unequivocally effective.

Discussion

Our results are consistent with those of earlier experimental studies showing that general cognitive restructuring can have a beneficial impact on clients who experience low self-esteem (Lamke et al., 1988; Warren et al., 1988). More important, our findings extend the treatment implications of ex post facto research indicating correlations between specific irrational beliefs and self-esteem (e.g., Daly & Burton, 1983; Erickson et al., 1991; McLennan, 1987; & Nielsen et al., in press). By tailoring a cognitive-restructuring intervention program to each individual's unique pattern of related irrational thoughts, we were able to effect appropriate changes on indices of rationality and self-esteem. Had scores not improved on our mediating measure of rationality, the causal link between specific irrational beliefs and low self-esteem would remain ambiguous.

At the outset of the study, we were concerned about the stringency of our control condition. Despite its documented beneficial effects, we wondered whether, because relaxation training is so widely used by mental health professionals, its luster might have dimmed among control participants, thus producing comparatively lower expectations for improvement. An unpublished demand analysis (Borkovec & Nau, 1972), available on the corresponding author's Website suggests otherwise; a comparison group preferred the control treatment. In retrospect, perhaps sophisticated interactive multimedia computer games are so commonplace in current high school culture that relaxation training now may be seen as more innovative and effective.

We began our study with no hypotheses about gender effects or interactions. Nevertheless, because male high school students in this culture have normatively more experience with computer applications than do female students, it seems appropriate that in future studies in this area, researchers continue to use gender as a blocking variable. It would be interesting to determine whether increased familiarity between (as well as within) genders leads to greater or lesser treatment success. Although both genders in the experimental condition showed improvement on measures of rationality (IBT) and self-esteem (Janis-Field), only experimental male students showed gains on the Rosenberg instrument. We do not believe that the latter effect derives from any differential relevance of the training materials. Both male and female models were depicted in the video clips, and we judged, a priori, that the entire package of situations was equally applicable to both genders. Whether the triple interaction here is simply an alpha level artifact or indicative of an underlying pattern in the data should be closely examined in future research.

Computer-based cognitive restructuring appears promising enough to warrant replications on the problem of self-

esteem, extensions to other counseling concerns (e.g., Kovalski, 1996), and long-term follow-up analyses. Despite its well-documented effects, cognitive restructuring is labor intensive, and a high level of expertise is needed to deliver it. Even thoroughly trained professionals would be hard-pressed to keep in mind the appropriate assessment questions that pertain to the irrational covariates of various clinical problems, much less be able to generate multiple impromptu logical analyses and cognitive modeling scripts.

Computers are immune to such problems. They ensure a high level of expertise in the delivery of replicable responses to varying patterns of client irrationality. Moreover, they are able to reach large audiences at low cost. To be sure, we are not advocating that computers replace mental health personnel. There may be more to the raising of self-esteem and the remediation of other clinical problems than the mere alteration of irrational thinking. For example, the kinds of computer simulations necessary to foster performance skills relevant to self-esteem among diverse clients have not even been designed, let alone evaluated; traditional behavioral rehearsal is still the state of the art. Computers may portend a quantum advance over bibliotherapy in the self-help arena, but for now they represent a resource rather than a replacement for professional wisdom and experience.

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