



Working Papers
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Research and Working Paper Series #208
1983

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Acknowledgments: The authors wish to thank Stephen Green, George Graen and Robert Joyner for their helpful comments on previous drafts of this working paper.

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Measuring Preference for
Ideation in
Creative Problem Solving

ABSTRACT

Creativity, problem solving and innovation performance are becoming of rapidly increasing concern to organizations in these times of accelerating change and environmental instability. An important construct identified in previous creative problem solving training research is called "preference for ideation". This paper reports development of a reliable and valid measure of this construct.

Creativity, problem solving, and innovation are becoming increasingly important topics in organizations in these times of rapidly accelerating technological change and economic and social instability. The ability to initiate and adapt to change is considered by many researchers as perhaps the single most important performance attribute of managers, engineers and scientists and other professionals and organizational members. Some major U.S. corporations have gone so far as to create a separate "department of corporate innovation" to stimulate and manage organizational creativity throughout the corporation. Increasing numbers of organizations are interested in learning about factors which may affect creativity. Some are attempting to develop creative problem solving training to try to increase innovation performance and/or to facilitate movement to a more organic, participative management style (Basadur, Graen and Green, 1982).

Many people believe that creative problem solving performance and innovation can indeed be increased by training (e.g., Simon, 1960; Joyner & Tunstall, 1970; Basadur, Graen and Green, 1982). The main purpose of this research is the development of a valid and reliable measure of a particular attitudinal construct called "preference for ideation" indicated in creative problem solving training research to be related to a cognitive construct called "ideation". "Ideation" is central to one particular training approach to creative problem solving. It is part of a sequenced two-step thinking process called "Ideation-Evaluation" identified by Basadur, Graen & Green (1982). "Ideation" is defined as the generation of ideas without evaluation. "Evaluation" is defined as the application of judgment to the ideas so generated. During ideation, judgmental, converging thinking is deliberately deferred in favor of non-judgmental, imaginative, diverging thinking. During evaluation the reverse holds. Basadur et al present a model of a "complete process of creative problem solving" in which the ideation-evaluation process

is repeated in multiple, sequenced and separate stages including problem finding, problem solving and solution implementation. Basadur (1982) and Parnes, Noller and Biondi (1977) describe other conceptually related "complete process" models.

Basadur, Graen & Green (1982) also identify an attitudinal construct which appears to be related to ideation called "preference for ideation". The research reported here builds on one of the future directions for research suggested in Basadur et al, that of strengthening the internal consistency, reliability and external validity of a preliminary scale developed in that research to measure "preference for ideation". Its early development is more fully described in Basadur (1979). Of the seven items in that preliminary scale, only two are relatively strong (internally consistent) measures of the "preference for ideation" construct. Thus, one purpose of the research reported in this paper is to report a new improved scale with additional and new items to provide better internal consistency. Also, reliability of the preliminary scale is quite low (Cronbach alpha = 0.45). Attitudinal measures in problem solving and decision making research sometimes tend toward relatively low reliabilities, e.g., Budner's Intolerance for Ambiguity: 0.49 (Budner, 1962) and Myers-Briggs Type Indicator: 0.70 (Mendelsohn, 1965). It is important to improve the original seven item scale to increase its reliability. Furthermore it is desirable to confirm the internal validity and to provide evidence of external validity of the new improved scale. This study evaluates the new scale by (1) confirming the factor analysis (internal validation) by which the items were selected for it; (2) establishing its reliability (Cronbach alpha); (3) establishing construct (external) validity of the new scale.

Method

Two scales were established from a previous study (Basadur & Finkbeiner, Note 1) of a very large questionnaire comprised of attitudinal items describing attitudes toward ideation. These two scales were intended to measure two of the factors obtained from a factor analysis of this large questionnaire. The scales are labelled "Preference for Ideation" (Scale #1) and "Tendency for Premature Critical Evaluation of Ideas" (Scale #2). They are shown in Tables 1 and 2. Scale #1 contains the two strong items of the preliminary seven item scale.

This was an independent study to establish the internal validity, reliability and external validity of the "Preference for Ideation" scale of Table 1. In this study, a new sample of 238 managers and professionals from across a variety of industrial, business and hospital organizations filled out a 14 item questionnaire (Appendix 1). This was derived by combining in randomized order the six items from Scale #1, "Preference for Ideation," and the eight items of Scale #2: "Tendency for Premature Critical Evaluation of Ideas." Scale #2 was included only to help validate Scale #1 as described below.

The data from the 238 panelists were factor analyzed to confirm that the two sets of items were indeed two separate factors as we believed from the previous study. The factor analysis was performed on the correlation matrix for the 14 items. The number of factors was decided by examining the stream of eigenvalues of the correlation matrix with diagonals reduced to the squared-multiple-correlations. Factors were extracted using a least-squares technique. The criteria used for rotation for interpretability were primarily those of simple structure. The technique is described in Tucker and Finkbeiner (Note 2). The final solution meets all of L.L. Thurstone's five criteria for unique determination of a simple structure (Thurstone, 1947).

Table 1

Scale #1: "Preference for Ideation"

<u>Item</u>	<u>Description</u>
1	I think everyone should say whatever pops into their head whenever possible.
2	I feel that all ideas should be given equal time and listened to with an open mind regardless of how zany they seem to be.
3	The best way to generate new ideas is to listen to others then tailgate or add on.
4	I like to listen to other people's crazy ideas since even the wackiest often leads to the best solution.
5	I feel that people at work ought to be encouraged to share <u>all</u> their ideas, because you never know when a crazy-sounding one <u>might</u> turn out to be the best.
6	One new idea is worth 10 old ones.

Table 2

Scale #2: "Tendency for Premature Critical Evaluation of Ideas"

<u>Item</u>	<u>Description</u>
1	Quality is a lot more important than quantity in generating ideas
2	Judgment is necessary during idea generation to ensure that only quality ideas are developed
3	We should cut off ideas when they get ridiculous and get on with it
4	You need to be able to recognize and eliminate wild ideas during idea generation
5	I should do some pre-judgment of my ideas before telling them to others
6	I wish people would think about whether or not an idea is practical before they open their mouth
7	A group must be focused and on track to produce worthwhile ideas
8	Lots of time can be wasted on wild ideas

As described more fully in the results section following, a two factor solution emerged with all six items of scale #1 loading on one factor and all eight items of scale #2 loading on the other factor. Cronbach alpha was then calculated for each scale. Internal validity and reliability had thus been assessed at this point.

Next, in assessing external validity, the panelists' response scores in each of the two scales were analyzed as described below. From the large sample, two nearly equal, smaller "known" groups of panelists were selected. These consisted of panelists who had been identified as being either high or low in their preference for ideation on the job by two independent expert judges (two people familiar with both the concept of ideation and also with the individuals' on-the-job attitudes and behaviors). The 238 panelists were participants in a variety of training programs. Expert judges were available for some of the training groups but not for the others. In all, the judges were available to consider 92 of the 238 participants. Each expert judge independently rated each of these participants as either "high" or "low" in preference for ideation or "don't know" if the judge felt there was insufficient experience with the participant to make an accurate judgment. The judges' independent ratings were then compared for each participant. Only those participants on whom both judges' ratings agreed, high or low, were assigned to the "known high" or "known low" groups. Where the judges disagreed or one or both assigned a "don't know" rating, the participant was assigned to the "unknown" group. The three group sizes were n=25 ("known high"), n=19 ("known low"), and n=48 ("unknown"). The other 146 participants (for whom expert judges were not available) were added into the "unknown" group providing a base of n=194 ("unknown"). Participants' responses to each of the 14 questionnaire items were scored on a five point scale (+2 = strongly agree through -2 = strongly disagree). Then scale scores were calculated by

averaging appropriate items for each of the two scales for each participant, thus creating single measures of the two factors.

It was intended to demonstrate the external (construct) validity of the new "preference for ideation" scale by showing that it discriminates two groups that it should discriminate while those two groups do not differ on a related construct. Thus group means on the two scales for each of the two groups were calculated and compared using a standard statistical test of significance (t-test).

Results

The first seven eigenvalues of the 14 item correlation matrix are displayed in Table 3. On this basis and after examination of residual correlations, a two factor solution was chosen.

Table 3

First Seven Eigenvalues of the Reduced Correlation Matrix

	1	2	3	4	5	6	7
<u>Eigenvalues</u>	3.50	1.42	0.37	0.20	0.14	0.09	0.02
<u>First Differences</u>	2.09	1.05	0.17	0.06	0.05	0.07	

After extracting two factors, the maximum residual correlation was 0.13. All the factor loadings greater than .30 are displayed in Table 4.

The correlation between the two factors was $-.36$. Study of these data confirms the factor structure obtained in the previous study. All items clustering on each of the two factors extracted in this study clustered on the same factors in the previous study in the same way. Also, none of the items on either factor in this new study loaded significantly on the other factor. The unrotated factor loadings are graphically displayed in Figure 1 showing the clear clustering of items from the two scales. Scale scores were then created as described above.

Table 4

Factor Loadings

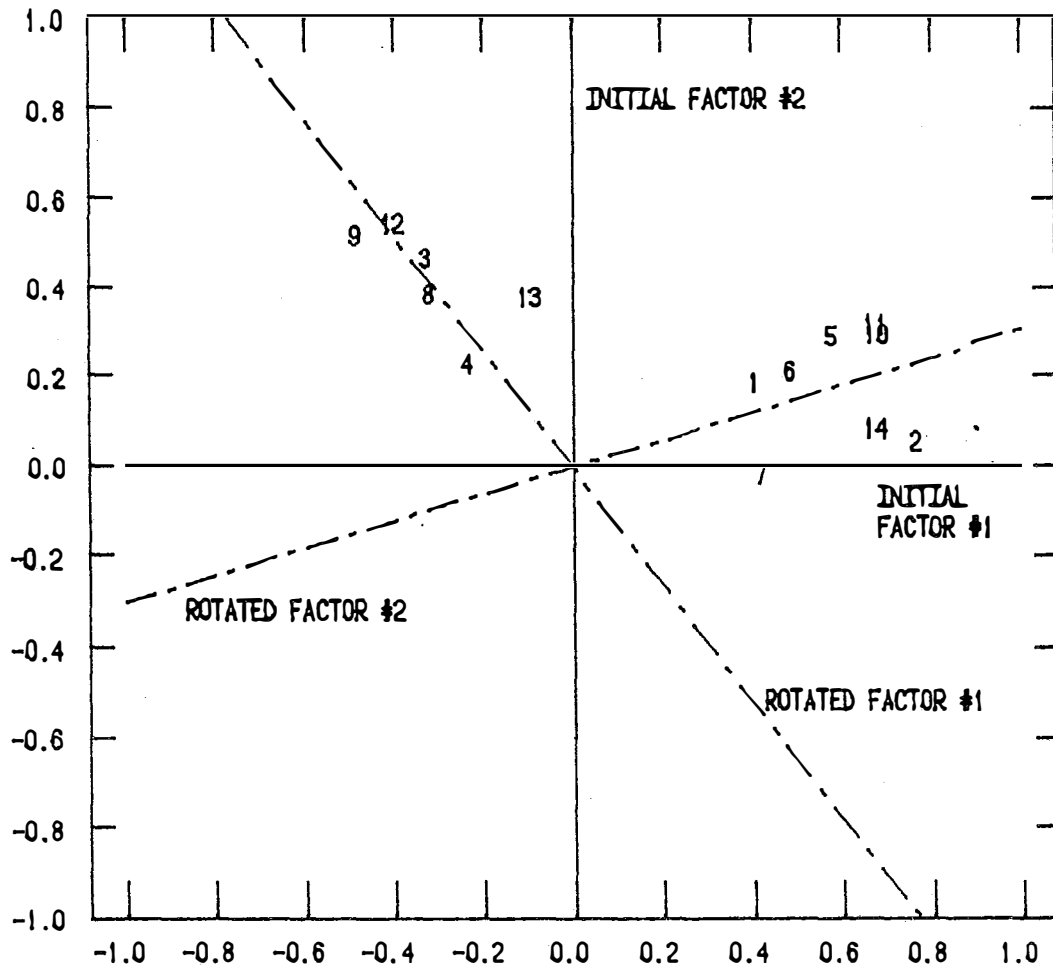
Item # in 14 Item Questionnaire	Factor this Item is intended to Load on	Loading on Factor #1 ("Preference for Ideation")	Loading on Factor #2 ("Tendency for Premature Critical Evaluation of Ideas")
12	1 (Table 1, item 2)	.68	-
9	1 (" " " 4)	.67	-
3	1 (" " " 5)	.56	-
8	1 (" " " 1)	.49	-
13	1 (" " " 3)	.42	-
4	1 (" " " 6)	.30	-
11	2 (Table 2, item 4)	-	.77
10	2 (" " " 2)	-	.76
2	2 (" " " 3)	-	.69
5	2 (" " " 1)	-	.69
14	2 (" " " 6)	-	.62
6	2 (" " " 7)	-	.55
1	2 (" " " 5)	-	.47
7	2 (" " " 8)	-	.35

The Cronbach alpha for Scale #1, the "Preference for Ideation", was calculated to be 0.68, indicating a moderate reliability, substantially higher than the 0.45 of the original preliminary scale. The Cronbach alpha for Scale #2, "Tendency for Premature Critical Evaluation of Ideas", was 0.83. Parenthetically, this suggests it may very well be feasible to do future research on this scale. The correlation of scale scores was -.26.

Thus the six item Scale #1 would appear to be an internally valid and moderately reliable measure of "preference for ideation". It would also appear that the eight item Scale #2 is an internally valid and substantially reliable measure of "the tendency for premature critical evaluation of ideas".

The results of the external validation work for Scale #1 follow. The participants' scale scores for each of the two scales are presented in Table 5. Maximum score on each scale is thus +2.0 and minimum is -2.0. Group means, standard deviations and comparative statistical tests of significance (t-test) are also provided. Data only from "known high" and "known low"

Figure 1
Graphical Representation of
Factor Loadings



Note - Numbers 3, 4, 8, 9, 12 and 13 represent the six items from Scale #1.
Numbers 1, 2, 5, 6, 7, 10, 11 and 14 represent the eight items from Scale #2.

Table 5

Participants' Averaged Scores and Group Means for "Known"

High and Low Preference for Ideation Groups

Scores on Scale #1: "Preference for Ideation"		Scores on Scale #2: "Tendency for Pre- mature Critical Evaluation of Ideas"	
Group 1	Group 2	Group 1	Group 2
"KNOWN HIGH" in Preference for Ideation (n=25)	"KNOWN LOW" in Preference for Ideation (n=19)	"KNOWN HIGH" in Preference for Ideation (n=25)	"KNOWN LOW" in Preference for Ideation (n=19)
0.83	0.83	-1.25	-1.00
0.33	-1.67	-0.25	-2.00
1.00	0.67	-1.75	-0.25
0.67	-0.50	0.63	-0.13
1.67	-0.67	-1.00	0.25
0.83	-0.17	-1.00	-0.75
1.00	0.00	-1.25	-0.13
-0.67	-0.17	-0.50	-0.88
1.67	0.00	-1.25	0.50
0.00	-0.67	0.00	-1.25
0.67	-0.67	-0.63	0.63
0.33	-0.33	-0.63	0.13
0.50	-0.17	0.75	-0.75
0.67	0.17	-0.50	0.00
1.17	-0.17	0.38	-0.38
0.33	-0.33	0.63	0.00
0.33	-0.67	-0.75	0.75
0.33	-0.67	-1.13	0.75
1.33	-0.50	-0.75	-0.75
1.17	-0.83	-0.75	
1.00		-1.88	
0.33		-0.50	
0.33		0.25	
1.00		0.75	
1.00		0.38	
Group Mean			
0.71	-0.29	-0.53	-0.24
Standard Deviation			
.52	.56	.69	.75
t-test, Group 1 vs Group 2	$t_{42} = 37.4$ ($p < .001$)		$t_{42} = 1.8$ (Not significant; $p > .185$)

participant groups are included since we did not include the "unknown" group in any validation analyses (not knowing anything about their preferences for ideation). However, the "unknown" group participants' data were included in the calculations for reliability and the confirmatory factor analysis above. The t-test comparing the "known high" to "known low" groups is a one-sided test for the "Preference for Ideation" scale since we have a definite hypothesis about which group should score higher. The t-test for the other scale, "Tendency for Premature Critical Evaluation of Ideas" is two-sided.

There was a significant difference in the hypothesized direction between the "known high" and "known low" group mean scores on the "Preference for Ideation" scale. There was not evidence of a significant difference between the same groups on the "Tendency for Premature Critical Evaluation of Ideas" scale.

Thus, there is significant evidence that the "Preference for Ideation" scale is able to discriminate between the two groups while at the same time the other scale does not discriminate. This provides support that the "preference for ideation" scale agrees with the expert judges in identifying participants' preferences for ideation. The measure of a related construct does not. Thus there is evidence of external validity of the "Preference for Ideation" scale as a measure of the "preference for ideation" construct.

Discussion

The authors propose that the instrument described in Table #1 is a suitably valid and reliable measure of the "preference for ideation" of an individual in an organizational setting. Useful future research directions would be to (1) attempt to further increase reliability beyond the 0.68 Cronbach Alpha demonstrated here; (2) develop further evidence of external

validity and generalizability by investigating additional organizations and increasing base size; (3) investigate the external validity of the eight item scale #2; and (4) use the six item "preference for ideation" scale in additional creative problem solving research such as in evaluating the effects of training, developing additional reliable and valid measures associated with ideation, and other research suggestions made by Basadur, Graen and Green (1982).

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Appendix 1

Instructions

Following is a series of questions which are designed to increase understanding of how people approach ideas and problem solving. None of these questions are meant to evaluate you in any way. There are no right or wrong answers.

Please answer each question as naturally and honestly as you can. Your best description of the world as you view it is what is wanted. Please write what you think.

Listed below are several statements concerning various situations. Read each statement carefully and indicate the extent to which you agree or disagree with the statements by circling the letter which corresponds.

A = Strongly Agree
B = Agree
C = Neither Agree Nor Disagree
D = Disagree
E = Strongly Disagree

1. I should do some pre-judgment of my ideas before telling them to others.

A B C D E

2. We should cut off ideas when they get ridiculous and get on with it.

A B C D E

3. I feel that people at work ought to be encouraged to share all their ideas, because you never know when a crazy-sounding one might turn out to be the best.

A B C D E

4. One new idea is worth ten old ones.

A B C D E

5. Quality is a lot more important than quantity in generating ideas.

A B C D E

6. A group must be focused and on track to produce worthwhile ideas.

A B C D E

7. Lots of time can be wasted on wild ideas.

A B C D E

A = Strongly Agree
B = Agree
C = Neither Agree Nor Disagree
D = Disagree
E = Strongly Disagree

8. I think everyone should say whatever pops into their head whenever possible.

A B C D E

9. I like to listen to other people's crazy ideas since even the wackiest often leads to the best solution.

A B C D E

10. Judgment is necessary during idea generation to insure that only quality ideas are developed.

A B C D E

11. You need to be able to recognize and eliminate wild ideas during idea generation.

A B C D E

12. I feel that all ideas should be given equal time and listened to with an open mind regardless of how zany they seem to be.

A B C D E

13. The best way to generate new ideas is to listen to others then tailgate or add on.

A B C D E

14. I wish people would think about whether or not an idea is practical before they open their mouth.

A B C D E

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