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ABSTRACT

A marker method (MM) and a rating method (RM) for testing a phasing hypothesis of family problem-solving interactions (PSIs) are compared. Focus was on studying the procedure employed in each method to test a phasing hypothesis of problem solving and how the methods compare against a set of criteria. In the RM, each family problem-solving episode was rated on the degree to which the behavior fit the criteria for orderly problem solving. The MM consisted of four stages: (1) introduction; (2) generation and assessment of alternatives; (3) resolution; and (4) decision. Data from a previous study of nine healthy, well functioning families (each including an adolescent) were analyzed using each method. PSIs were measured through laboratory videotaped family interactions involving two types of problem-solving tasks. The taped interactions were coded using a 26-category taxonomy developed to assess conflict resolution. Results indicate that both methods offer efficient procedures for testing the phasing hypothesis of family problem-solving behavior. The RM scored higher on more of the criteria than did the MM. Eight tables and three figures are included. (TJH)

Comparing Two Methods of Analyzing Problem Solving Interactions

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Abstract

The purpose of this paper is to compare two methods (a marker method and a rating method) for testing a phasing hypothesis for family problem solving interactions. Problem solving is a key function for healthy family functioning, however researchers know little about the actual process families use to solve problems. Some researchers (e.g., Kieren & Hurlbut, Gora & Lehman, 1985; Kieren, Vaines, Badir, 1984) argue that family problem solving is a stepwise or a phase oriented process.

The question answered in this paper is how does a marker method (Kieren & Hurlbut, 1985) of coding family problem solving interactions compare to a rating method. The specific questions are: (a) what procedure does each method employ to test a phasing hypothesis of family problem solving? and (b) how do the two methods compare against a set of criteria?

Data from a previous study of nine families with an adolescent have been analyzed using a marker method (Kieren & Hurlbut, 1985). This same data was analyzed using a rating system. All families in this study were categorized as falling in the "well functioning" or "healthy" level of family functioning as measured by scores on three measures and the members of all families reported satisfaction with their problem solving effectiveness.

Family problem solving interactions were measured through laboratory videotaped family interactions on two types of problem solving tasks. For both methods, the family's video

taped interactions were coded by trained coders using a 26 category taxonomy developed for conflict resolution by Raush, Barry, Hertel, and Swain (1974).

For the marker method, the data was analyzed with a multivariate solution for four one group *t* test. For the rating method, the data was analyzed with a one group *t* test. The null hypothesis of random problem solving behavior was rejected using both methods. The two methods were then compared using a set of established criteria. Such an analysis is of value to all of us interested in studying family problem solving.

Introduction

Family problem solving is an important part of family interaction (Klein & Hill, 1979; Montgomery, 1981). Family groups engage in the resolution of problems associated with a whole range of life experiences which comprise new or changed conditions that make old habitual responses inappropriate or ineffective. Tallman (1970) has labeled these experiences as problems. The important components of family problem solving are situations which involve (a) at least two or more family members, (b) a desired goal or outcome and (c) something which prevents reaching the goal (e.g., no decision available). Problem solving includes handling both severe disruptions and daily routines which demand a decision. It has been argued that family groups that are able to solve problems function better than those that are not able to solve problems.

Even though family problem solving is seen as an important family activity, it is not well researched. There is little descriptive data or empirical data which analyzes the family's process of problem solving. There are not accepted methods to analyze family problem solving. The purpose of this paper is to compare two methods for analyzing family problem solving interaction.

Klein and Hill (1979) offer a theoretical discussion of problem solving effectiveness which has been a guide for the present research. Problem solving interactions can be analyzed in terms of an emphasis on sequencing, amount of interaction, distribution and normaltivity of behavior. In this research project sequencing of problem sclving has been emphasized in that "phasing rationality" has been the focus (Kieren & Hurlbut, 1985). According to Klein and Hill (1979) phasing rationally is a process of family problem solving which is characterized by orderly and sequential phases or steps. These phases usually begin with a phase in which the family identifies the problem and ends with the family evaluating their solution (Brim, Glass, Lavin, & Goodman, 1962; Kieren et al., 1984). As Klein and Hill (1977) propose phasing rationality is defined as "the orderliness with which a family progresses through the problem solving process" (p. 522). Herein, a family's problem solving is considered more rational the more closely the sequence of behaviors resembles a theoretical ideal sequence of phases (e.g., Kieren et al., 1974). Data supporting a rational model of problem solving has been equivocal. Some data have found that there are distinct and characteristic stages within total process of problem solving within families or in other small groups of people (Bales & Strodtbeck, 1951; Gottman, Markman & Notorius, 1977; Raush, et al., 1974). Other data show no evidence of rational phasing (Aldous & Ganey, 1985; Simmons, Klein & Thornton, 1973). In general, each of these studies use a different theoretical description of the ideal model of problem solving phases and they use different tests and analyses of phasing. It is the different tests and analyses that is addressed in this paper.

The present paper extends Kieren and Hurlbut's (1987) work presented at the pre-conference theory construction workshop.

In this pre-conference paper, the Bales and Strodtbeck (1951) method and the marker method (Kieren & Hurlbut, 1985) were compared in some depth. A third method, the rating method, was introduced.

The present paper builds on this initial work by an indepth comparison between the marker technique and the rating technique. Data from 27 family problem solving interactions were used to answer two questions. What procedure does each method employ to test a phasing hypothesis of family problem solving interaction? How do the two methods compare against a set of criteria?

Criteria adapted from Kieren and Hurlbut (1987) were used to answer the second question. These are:

1. Fit with theory: Is the method congruent with the theory used in the research and does it capture all the important aspects of the theory.

2. General applicability. Can the method be used with other ideal models of phasing?

3. Answers research question economically: Does it answer the research objectives economically (in terms of money and people hours)?

4. Free of bias toward phasing: Is there bias in the procedure and analysis that would favor rationality.

5. Index of rationality: Does the method provide an index of rationality that can be used in other analyses.

6. Empirical test: Is there a valid and reliable method available that is economical and easy to use.

The analysis with either the marker or rating techniques depends upon an ideal model of problem solving sequencing. Even though one ideal model is used herein, the general technique is applicable to problem solving research using other ideal models which describe sequencing of problem solving behaviors.

The ideal model for problem solving phasing used in this research is presented below. It has been adapted from the model presented in Kieren, Vaines, and Badir (1984). The phases identified in the model are hypothesized to be "qualitatively different subperiods within a total continuous period of interaction in which a group proceeds from initiation to completion of a problem involving group decision" (Bales & Strodtbeck, 1951, p. 485). These different subperiods are labeled phases. As figure one shows phases proceed from identification of the problem to evaluation of the action and solution.

Insert Figures One and Two About Here

Any episode of family problem solving may consist of one set of phases or more than one set of phases. The family group may recycle through all or some of the hypothesized phases until a final solution is accepted or the interaction ends. Each set of phases has been labeled a problem solving loop. As figure two indicates these loops may consist of a complete set of phases or a partial set. In order to simplify the analysis at this initial stage of testing, only loop one of each family's interaction was analyzed.

The Study

Nine family groups (mother, father and adolescent child with or without diabetes) were studied in a multimethod study of family problem solving interaction. The data consisted of 27 problem solving interactions, comprising nearly 1800 interaction units. Problem tasks were developed by the researchers (Kieren, Hurlbut, Lehman, & Gora, 1985), and had a format similar to Olson and Ryder's Inventory of Marital Conflicts (1970).

Typical problem solving situations were identified through the general adolescent literature and the literature addressing family relations issues for teenagers who have diabetes. Nine situations were chosen and problem solving vignettes were written addressing these issues. Separate parallel forms were written for male and female adolescents and for adolescents with and without diabetes. Respondents were asked to independently answer a series of forced answer questions about each vignette.

A sample situation follows:

> Bob, age 15, and Chuck, age 15, are good friends. They have gone to school together since kindergarten. Bob's parents had always liked Chuck but they have heard from a neighbor that Chuck was picked up by the police last week for drinking. They want Bob to stop seeing Chuck because he might be a bad influence on him. Bob thinks his parents don't understand. He's old enough to choose his own friends. He tells his parents that they are treating him like a baby and refuses to talk about it any more.

INDIVIDUAL ANSWER FORM

M Adol–Diab.
Code No._____

Problem situation	What is the problem?	Has a situation like this ever happened in your family?	Who is most responsible for the problem?			What should they do?	Who should make final decision in this situation?			
			Father	Mother	Child		Father	Mother	Child	Both parents
Conflict regarding friends	A. Bob's decision to keep Chuck as a friend. B. Deciding how much independence Bob should have.	A. Yes B. No				A. Bob should stop seeing Chuck. B. The family should discuss it more C. Bob should make his own decision about friends.				

Comparison of individual responses to the question, "Has a situation like this ever occurred in your family?", provided information about the salience of the situation for the family. A situation was deemed to be salient to the family if two or more family members reported it, or a situation like it, had occurred in their family, and if there were differences of opinion in handling the situation by at least two family members. Based on this information, two salient vignettes were chosen to be discussed as the family problem solving situations. The family's task was to arrive at a consensus on all of the questions posed. In addition, all families discussed a common third situation. The family problem solving interaction was coded using a 26 category taxonomy. It was developed by Kieren (1985) and modeled after the code developed for conflict resolution by Raush et al. (1974).

The interaction was coded without transcription using an OS3 Data Coding device (Holm, 1981). Use of data logging equipment without transcription or time intervals prevents the determination of item-by-item reliability since the unit being coded may not be the same for each coder. Thus, reliability was assessed in the following three stage process during training:

1. The average coder accuracy for two coders was 98%. Coder accuracy refers to how well an individual coder understands and recognizes the coding categories.

2. Average unit agreement was 98%.

3. Inter-coder reliability, assessed by Cohen's Kappa (Cohen, 1960), using training transcripts, and estimated over summary codes, was .75. This compares favorably to .67 reported by Raush et al. (1974) on their similarly complex behavioral code.

Data Analysis

Before the data were analyzed the data were truncated so that only loop one for each of the 27 problem solving episodes was used for analysis. The determination of the first loop was based upon the Kieren et al. (1984) model of problem solving interactions (See Figures One and Two). Once the family interaction was coded, using the 26 category codes, the first problem solving loop in a total problem solving sequence was determined by the following criteria. Loop one began at the beginning of the family interaction, and was completed once the following occurred:

1. At least one identification behavior.

2. Followed by at least one generation of alternative behavior.

3. Followed by at least one assessment of alternative behavior.

4. Followed by at least one resolution mechanism behavior.

5. Followed by at least one decision behavior, or a consecutive combination of decision and decision evaluation behaviors.

The first problem solving loop ended once all of the above behaviors have been located in the correct sequence. Only this loop one data was analyzed herein. Note that the goal setting behaviors were not used in the criteria to determine the loop one data sets. Goals occurred too infrequently. There were a total of three goals coded for the first loop of all 27 vignettes.

The Rating Method

The rating score. In the rating method each family problem solving episode was rated on the degree to which its blem solving behavior fits the criteria for an orderly solving process. With such a rating method a [illegible] her arrives at an aggregate score. This score is based on two rimary criteria: (a) family problem solving is more rational if each of the seven types of problem solving behaviors illustrated in figure one are present and (b) it is more rational if these behaviors occur in the predicted order. The rating sheet in Table one illustrates that the points were given for the presence and sequencing of the predicted behaviors.

Insert Table One About Here

One point each was given for the presence of the predicted behaviors and one point each for an example of the rating summary categories occurring in the predicted order relative to each other rating summary category. "R" in the table refers to the rating summary categories which correspond to the phases in Figure one. For instance R1 refers to the identification behaviors and R2 to goal generation behaviors.

In rating these pairwise comparisions of rating categories, the sequencing had to occur in a specific part of the interaction. For example, according to Figure one, identification behaviors (R1) should occur first in the problem solving episode. In order to rate the R1 sequencing, the rater looked for the first example of an identification (R1) behavior in the episode. If no R2, R3, R4, R5, R6, or R7 behaviors occur between the beginning of the interaction and this R1 coded behavior, one point is put in each of the blanks for predicted sequencing. A one would go beside "R1 before R2" and a second one beside "R1 before R3" and so forth. That is, as long as there was an R2 and so forth in the loop one data. If any of the summary categories were missing in loop one, a zero went in its respective blank. However, if a R3 and R7 behavior are found in the segment between the first interaction and R1, a score of one would go in all blanks except the "R1 before R3" and "R1 before R7" blanks. These two blanks would receive a score of zero.

Once the sequencing of the identification (R1) behaviors was scored, the goal generation (R2) sequencing was scored. The rater looked for the first goal generation behavior subsequent to the R1 behavior used previously. Only the segment of data between the previous R1 behavior and this goal generation (R2) behavior was rated for the R2 sequencing. The rating proceeded using the same procedure as with the rating for the R1 sequencing. This procedure was used to rate the remaining sequencing of rating categories. That is the data for rating the alternative (R3) sequencing began at the behavior used for rating the R2 sequence and proceeded until the first R3 behavior occurred and so forth.

The total rating score was determined by summing the scores received for presence and sequencing of behaviors. The maximum score was 28 points. This score was used for analyses and as an index for rationality.

To determine whether the nine families' problem solving behavior conformed to the ideal model, the phasing hypothesis was tested. In order to test this hypothesis, we needed to determine what rating score constituted rational phasing and what score indicated random sequencing of behaviors.

To do that, the rating score was compared to rating scores from 100 randomly generated sequences of the 27 problem solving interactions. The original entire data from each of the 27 family problem solving episodes was randomly generated into 100 different orders. Loop one of the problem solving episode was determined for each of these generated orders of the data. These sequences of behaviors were then rated using the previously described method. The rating scores for each of the 27 problem solving interactions was compared to those from the 100 generated data sequences. Table two shows the frequency of the different rating scores. The circled frequency indicated

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Insert Table Two About Here

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the position of the family's actual rating score. Since the total frequency of the generated sequences is 100, the probability of the actual rating score being due to random sequencing was calculated by adding the frequency for those scores that were equal or higher than the score the family achieved. The above calculations were done using Absoft Fourtran, Version 2.3 with a Macintosh.

A one group t test was used to test the hypothesis of phasing or to test the null hypothesis that the population mean was less than or equal to zero. The sample mean used for the t test was calculated by first subtracting the mean rating score for each of the 100 generated sequences from the actual rating score corresponding to that set of sequences. Next a mean of these differences was calculated for each family by averaging across the difference scores for the three problem solving episodes for each family. Table three shows the resulting nine difference scores. The null hypothesis was rejected [$t(8) = 4.86$, $p = .0013$] with a sample mean of 1.714 and a standard deviation of 1.059.

Insert Table Three About Here

The Marker Method

The marker score. The seven categories of behaviors identified for the rating system (those numbered in Figure 1) were collapsed into four summary categories for the marker system. Table four indicates that the first category for the marker system (identification) was a combination of the first two rating summary categories (identification and goal generation). The second category for the marker system (alternative exploration) was a combination of the third and fourth rating summary categories (generation of alternatives and assessment of alternatives). The resolution summary category for the marker method and the resolution mechanism (R5) for the rating method were identical. The fourth category for the marker method (Decision Process) was a combination of the last two rating summary categories (decision and evaluation of decision). These four marker summary categories were used to demarcate phases of problem solving. The four phases were:

Phase I: Introduction began with the beginning of the discussion and ended at the code immediately preceding the first proposed alternative code.

Phase II: Generation and Assessment of Alternatives began with the first proposed alternative code and ended at the code immediately preceding a resolution code.

Phase III: Resolution began with the first code that represented a resolution code and ended at the code immediately preceding a decision code.

Phase IV: Decision began and ended with the first decision code or consecutive decision codes.

A new loop began as soon as another behavioral code appeared.

Descriptive statistics were computed to determine the frequency of behaviors within each phase and each problem solving summary category. Figure three gives an example for one family vignette. The cells with zero frequency, the ones without letters, cannot have items due to the use of these summary categories to demarcate transition to the next phase.

Insert Figure Three About Here

The null hypothesis of random sequencing of behavior was tested using Kieren and Hurlbut's (1987) criteria. The hypothesis can be rejected if the (a) highest proportion of column behaviors (phase specific behavior) corresponds to the category of behaviors predicted by the model (within phase analysis) and (b) highest proportion of row behaviors (summary category) corresponds to the phase predicted by the ideal model (across phase comparison). For instance identification behaviors and no other category of behaviors should constitute the highest proportion of phase I behaviors (within phase test) and the highest proportion of identification behaviors should be in phase I and not the other three phases (across phase comparison). This tests the identification category and phase I. It will be labeled the identification test or test one.

Test two analyzes whether exploration of alternatives are the highest proportion of phase II behaviors and if more of them are in phase II than any other phase. Test three analyzes the resolution mechanisms and phase III for the within phase and across phase tests. Test four analyzes the decision processes and phase IV for the across phase test. There is no within phase comparison since no other category can appear in phase four.

The marker analysis. To test the null hypothesis using the above criteria, 12 pairwise comparisons were scored. Using figure three as a guide, the pairwise comparisons for (a) comparison group one (identification) were A > B, A > C, A > F, and A > H, (b) group two (alternative explorations) were F > B, F > I, and F > E, (c) group three (resolution mechanisms) were G > F, G > C, and G > E and (d) group four (decision process) were J > H and J > I. For each comparison a score of +.5 was given if the comparison was in the predicted direction and -.5 if it was not. For each family, the scores were summed across the vignettes and then averaged across the comparisons within each of the four comparison groups. The scores ranged from -1.5 to +1.5; a score of greater than zero was in the direction with the ideal model and a score of zero or less went against the ideal model. Table five presents the data calculated from the pairwise comparisons.

Insert Table Five About Here

Data from each of the four comparison groups was analyzed with a one group t test with the null hypothesis being $\mu \leq 0$ which represents randomness. The multivariate solution for multiple one group t tests was used to control the overall alpha level. The index for rationality was calculated by adding the scores from all the 12 pairwise comparisons.

Results and Discussion

As Table six shows the null hypothesis using the rating method was rejected supporting the phasing hypothesis. The phasing hypothesis received partial support from the marker method. The multivariate F and two ts were signifi·ant (See Table Six). The identification and the alternative generation comparisons supported the phasing hypothesis whereas the other two comparisions did not.

Insert Table Six About Here

The results indicate that both methods can be used to test the phasing hypothesis. At first glance it appears that the marker method yields a more sensitive and informative result. It indicates in which of the four phases the data disagree with the phasing hypothesis. In contrast, the rating method only offers an overall agreement or disagreement test.

Before accepting the marker method too quickly, let's evaluate the two methods using the criteria.

First both methods fit the theory. They follow the sequences of phases represented in Figure one and both can be expanded to include more than one loop as predicted by the model. It appears, however, that both only partially capture the richness of the model. The marker method does not individually test all the phases in the ideal models. In the marker method, the eight phases are collapsed into four phases whereas with the rating method seven of the eight phases are used. On the other hand, the rating method ignores much of the available information in the data. In this method frequency of behaviors in the predicted order is not incorporated into the scoring. A count of one behavior in the predicted order is treated as equal to a count of n + 1 behaviors whereas the marker method is based upon frequency of behaviors in the predicted order. The question of concern is what constitutes nonrandom phasing? One identification behavior followed by one alternative behavior or 10 of the first followed by 10 of the second. This question is left unanswered at the present time but needs to be answered to determine whether the present rating method needs to be reworked.

Both methods have general applicability. They can be used with any ideal model of phasing in problem solving as long as the model has (a) clearly demarcated steps or phases determined by one behavior code, (b) presence as one criteria for phasing and (c) sequencing as a second criteria for phasing.

Once the data are coded, both methods are easy to use and relatively economical. The rating method was more economical to analyze than was the marker method. The rating analysis took 15 hours for a first year graduate student to complete and much of the analysis was completed on the Macintosh which kept the computing cost to about $20. The analysis using the marker method took an experienced consultant 30 hours to complete and most of it was completed on the university's mainframe computer at a cost of between $200 and $300.

Both techniques may have some bias towards rationality in the way the phases are demarcated; however most of this bias is eliminated by the tests used. It might be argued that using the elements of the ideal model as a means of rating a family's interaction is biased. This may be true but, this was not a problem for the analysis with the rating scores. For the rating technique the rationality bias was incorporated into the generated data's rational score. Comparing the score for the actual data to the mean for the generated data is a rigorous measure independent of bias towards rationality.

One might agree that there is bias in the marker method by using the summary categories to demarcate phase change and then testing the category's behavior within a phase. This should not be a bias since the relative frequency of behaviors within and across phases should be independent of the one behavior which demarcated the phase change. That is, as long as the frequency of behaviors in any phase is some number greater than one. There is a problem in the within phase analysis that may bias for or against the phasing hypothesis. The expected frequencies in each cell of Figure three are not equal. An assumption of the present method is equal marginal probabilities. In Figure three look at cell A and H. Since there are many more alternative exploration behaviors than decision behaviors, it would be difficult to not reject a test of the comparision D > I without formulating a decision rule using the marginal probabilities tc calculate percentages in each cell. Such an inbalance of marginal probabilities could also work against the phasing hypothesis.

Both methods offer indices of rationality which are easy to calculate and which can be used to rank the families according to their level of problem solving orderliness.

Insert Table Seven About Here

Table seven indicates that the ranks for the two methods are not completely consistent. There are four cases in which the ranks are generally consistent, three in which they are inconsistent and three in which they are inconclusive. These three inconclusive cases could not be determined due to the ranking ties in the marker method. The lack of consistency in ranks may be due to the bias described earlier or the two indices of rationality may be measuring different aspects of the model. Which aspects remain unknown at this time. In order to determine which of the two measures is the better predictor of phasing, external validity measures need to be tested.

At this point, the statistics for both methods are easy to understand and economical. Arriving at <u>an empirical test</u> has been very time consuming and at many times frustrating. A problem with both analyses is that they require a certain number of problem solving categories to arrive at a rating score with enough variance to show a range of permuted sequences and to have enough codes to have a large enough frequency in the cells in the marker method. Examining the loop one data in conjunction with Table three, it appears that more than three problem solving categories are necessary.

In summary both methods offer efficient procedures that can be used to test the phasing hypothesis of family problem solving behavior. The rating method is higher on more of the criteria than is the marker method. See Table eight. The rating method is more economical and suffers from less bias towards rationality than does the present marker method. The marker method's bias can be resolved by using marginal probabilities as well as the individual cell frequencies in the analysis. The rating method has a simpler and more sensitive index of rationality than does the marker method. The marker's index has too many ties.

Insert Table Eight About Here

Even though the rating method fares a bit better with the evaluation, the marker method is the method of choice when the ideal model considers frequency of problem solving behaviors to be an important aspect of the test of phasing. There may be still a better method which is economical and simple. We are eager to hear of such a method.

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TABLE ONE
RATING SCORE SHEET

FAM: ______ VIGNETTE: ______ LOOP: ______

PRESENCE OF BEHAVIOR

IF R1[A] (1, 15, 16, 17)[B]	______[C]
IF R2 (2)	______
IF R3 (3)	______
IF R4 (4, 5, 6)	______
IF R5 (7, 8, 9, 10, 11, 12)	______
IF R6 (13)	______
IF R7 (14)	______

SEQUENCE OF BEHAVIOR

R1 BEFORE R2	______
BEFORE R3	______
BEFORE R4	______
BEFORE R5	______
BEFORE R6	______
BEFORE R7	______
R2 BEFORE R3	______
BEFORE R4	______
BEFORE R5	______
BEFORE R6	______
BEFORE R7	______
R3 BEFORE R4	______
BEFORE R5	______
BEFORE R6	______
BEFORE R7	______
R4 BEFORE R5	______
BEFORE R6	______
BEFORE R7	______
R5 BEFORE R6	______
R7	______
R6 BEFORE R7	______
TOTAL (28)	______

[A]R REFERS TO THE DIFFERENT RATING SUMMARY CATEGORIES.

[B]THE NUMBERS IN PARENTHESES REFER TO THE BEHAVIOR CODES.

[C]BLANK IS FILLED WITH A 1 IF ANSWER IS YES AND 0 IF ANSWER IS NO.

Table Two
Frequency of rating scores for generated sequences

Rating Score	12[a]	13	14	22	23	24	32	33	34	42	43	44	52	53	54	62	63	64	72	73	74	82	83	84	92	93	94
2					28																						
3					72								5	6	7					5							
4										1	2		13	13	9				4	14						1	
5		2	2			3	2	2	4	1	11	2	25	26	27			1	10	37	10			1		3	
6	1	4	7			9	3	3	8	3	14	2	57	55	57	1	1	5	11	44	8	3		3	3	4	
7	4	3	12	1		18	5	7	13	17	21	4				2	5	3	9		8	6	2	10	8	13	
8	3	12	14	1		35	6	12	19	27	22	5				6	5	6	22		6	9		12	10	7	
9	12	24	20			35	17	4	18	51	35	9				7	13	19	30		11	11	2	16	15	19	2
10	30	10	16	4			16	11	12		5	23				20	22	12	14		13	17	9	17	11	21	6
11	15	17	15	12			15	16	12			15				8	21	20			9	17	11	19	14	18	12
12	15	17	9	15			18	20	10			19				18	16	22			13	19	21	7	18	10	12
13	9	7	4	19			9	13	4			12				13	8	11			10	10	23	9	17	4	14
14	6	2	1	13			5	7				7				8	7	1			8	8	15	5	4		9
15	5	2		9			4	5				2				4	2				4		7	1			22
16				9												4							3				3
17				7												3							2				7
18				5												3							4				4
19				3												2							1				2
20				2												1											5
21																											
22																											
23																											1
24																											1
P level	.20	.02	.05	.67	.72	.35	.36	.76	0	.51	.30	.55	.57	.55	.57	.06	.54	.85	.44	.44	.12	.54	.17	.06	.04	.53	.13

Note: The circled number locates the score for the actual data.

[a] ...s represents the number for the family followed by the number for the vignette. This example is family one vignette ...).

Table Three

RATING ANALYSIS

FAMILY*	VIGNETTE	SCORE[a]	MEAN $_g$ [b]	SCORE-M_g=d	M_d [c]
1	2	13	10.870	2.13	
1	3	15	10.070	4.93	3.60
1	4	13	9.270	3.73	
2	2	13	13.810	-0.81	
2	3	3	2.720	0.28	0.19
2	4	9	7.900	1.10	
3	2	12	10.520	1.48	
3	3	9	10.770	-1.77	1.58
3	4	14	8.970	5.03	
4	2	9	8.210	0.79	
4	3	9	7.450	1.55	0.853
4	4	11	10.780	0.22	
5	2	6	5.340	0.66	
5	3	6	5.300	0.70	0.673
5	4	6	5.340	0.66	
6	2	18	12.030	5.97	
6	3	11	10.730	0.27	1.627
6	4	9	10.360	-1.36	
7	2	9	7.810	1.19	
7	3	6	5.200	0.80	2.037
7	4	14	9.880	4.12	
8	2	11	10.580	0.42	
8	3	15	12.820	2.18	2.207
8	4	14	9.980	4.02	
9	2	14	10.460	3.54	
9	3	10	9.410	0.59	2.657
9	4	18	14.160	3.84	

[a]Score = rating score for actual data. [b]M_g= mean rating score for 100 generated sequences by family and vignette. [c]M_d = mean difference scores by family and across 3 vignettes. The *t* tests uses these means.

Table Four

PROBLEM SOLVING SUMMARY CATEGORIES
AND BEHAVIORS CODED

Summary Category	Code number	Behaviors Cited
Identification	1	Identifies problem
	2	Establishes a goal
	15	Positive evaluation of potential ability
	16	Negative evaluation potential ability
	17	Assesses problem
Exploration of Alternatives	3	Proposes an alternative
	4	Explores consequences of alternative
	5	Positive evaluation of specific alternative
	6	Negative evaluation of specific alternative
Resolution Mechanism	7	Cognitive reasons for alternative
	8	Compromise
	9	Appealing to Fairness
	10	Coaxing
	11	Power
	12	Commanding
Decision Process	13	Makes decision
	14	Evaluates solution and process

Table Five

DATA CALCULATED FROM PAIRWISE COMPARISONS IN MARKER METHOD

	COMPARISON GROUP			
	One	Two	Three	Four
	Identification	Alternative Explanation	Resolution Mechanism	Decision Process
Family	M_I	M_A	M_R	M_D
1	1.250	1.500	1.167	1.000
2	0	1.500	.500	.500
3	.500	1.167	.833	-.500
4	.500	.833	.833	0
5	.500	1.167	-1.167	-1.500
6	.250	.500	.833	.500
7	.500	.167	-.167	-.500
8	.500	.833	1.167	-.500
9	-.250	.500	0	0
M	.417	.907	.444	-.111

<u>Note</u>. M_I = (Score for A>B + Score for A>C + Score A>F + Score for A>H) divided by 4. M_A = (Score for F>B + Score for F>I + Score for F>E) divided by 3. M_R = (Score for G>F + Score for G>C + Score for G>E) divided by 3. M_D = (Score for J>H + Score for J>I) divided by 2. $-1.5 \leq M \leq +1.5$ for all M_I, M_A, M_R, and M_D.

TABLE SIX

RESULTS

UNIVARIATE TESTS OF THE PHASING HYPOTHESIS

RATING METHOD

	$\underline{M}$	$\underline{SD}$	$\underline{SE}_{\underline{M}}$	$\underline{t}^a$	$\underline{p}$
	1.714	1.059	.353	4.86	.0013

MARKER METHOD

COMPARISONS	$\underline{M}$	$\underline{SD}$	$\underline{SE}_{\underline{M}}$	$\underline{t}^a$	$\underline{p}$
ONE	.417	.415	.138	3.02	.017
TWO	.907	.465	.155	5.86	.0004
THREE	.444	.764	.255	1.74	.119
FOUR	-.111	.741	.247	-0.45	.665

NOTE: THE MULTIVARIATE ONE GROUP $\underline{t}$ TESTS FOR THE MARKER METHOD WAS SIGNIFICANT $\underline{F}(4, 5) = 6.77$, $\underline{p} = .030$.

[a] $\underline{DF} = 8$

Table Seven

COMPARISON OF INDICES ON RATIONALITY

	Index of Rationality		Rank [c]		Agreement Among Ranks [d]	
Family	Marker [a]	Rating [b]	Marker	Rating	Marker	Rating
1	15	13.67	1	2	H*	H*
2	7	8.33	2-5	8	H/M**	L**
3	7	11.67	2-5	5	H/M	M
4	7	9.67	2-5	6-7	H/M**	L/M**
5	-1.0	6.00	9	9	L*	L*
6	6	12.67	6	4	M*	M*
7	1	9.67	7	6-7	L	L/M
8	7	13.33	2-5	3	H/M	H
9	-.5	14.00	8	1	L**	H**

[a] Range of -18 to +18; the higher the score, the more support for the ideal model. [b] Range of 0-28; the higher the score, the more support for the ideal model. [c] Families were ranked from highest score which represented the highest level of rationality to lowest score. [d] Rankings in c were divided into thirds: H = rank 1,2,3: M = rank 4,5,6; L = rank 7,8,9.

*Consistent rankings; **Inconsistent rankings.

TABLE EIGHT

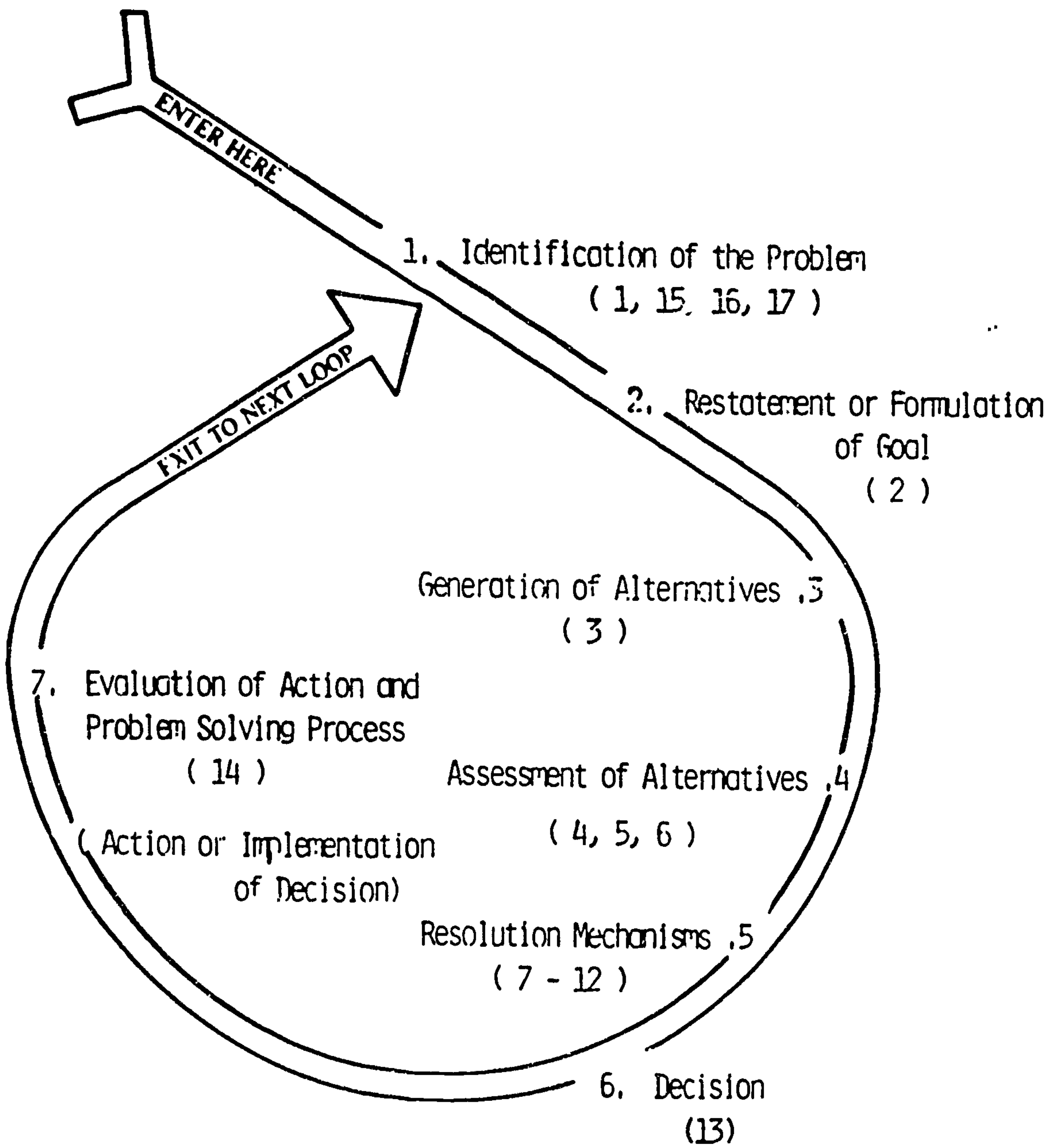
SUMMARY: BOTH METHODS COMPARED AGAINST A SET OF CRITERIA

	METHOD	
CRITERIA	RATING	MARKER
FIT WITH THEORY	P	P
GENERAL APPLICABILITY	P	P
ANSWERS RESEARCH QUESTION ECONOMICALLY	H	H
FREE FROM BIAS TOWARD PHASING	H	P
INDEX OF RATIONALITY	H	P
EMPIRICAL TEST	P	P

NOTE. "H" MEANS THE METHOD IS SUPPORTED BY THE CRITERION. "P" MEANS THE PARTIALLY SUPPORT FOR THE METHOD USING THIS CRITERION. "L" MEANS LOW SUPPORT FOR THE METHOD USING THEIR CRITERION.

Figure One

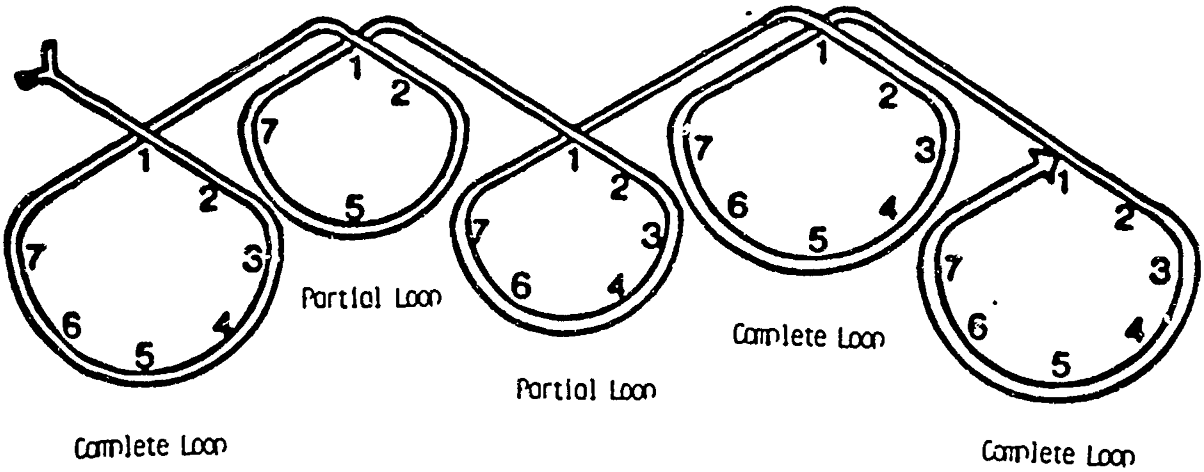
ONE COMPLETE PROBLEM SOLVING LOOP



adapted from: Kieren, D., Vaines, E. & Badir, D. (1984) <u>The Home Economist as a helping professional</u>. Winnipeg, MN: Frye, p. 85

Figure Two

FAMILY GROUP PROBLEM SOLVING OVER A SHORT TIME SPAN



adapted from: Kieren, D., Vaines, E. & Badir, D. (1984)
The Home Economist as a helping professional. Winnipeg, MB: Frye, p. 85

Figure Three

PROPORTIONS OF PROBLEM SOLVING BEHAVIOR
FOR LOOP ONE

For Family 3 Vignette 3

PROBLEM SOLVING SUMMARY CATEGORY FREQUENCY PERCENT ROW PCT COL PCT	PROBLEM SOLVING PHASE I	II	III	IV	Across
Identification	A 1 3.70 20.00 33.33	B 4 14.81 80.00 25.00	C 0 0.00 0.00 0.00	0 0.00 0.00 0.00	5 18.52
Exploration of Alternatives	0 0.00 0.00 0.00	D 9 33.33 81.82 56.25	E 2 7.41 18.18 28.57	0 0.00 0.00 0.00	11 40.74
Resolution Mechanism	F 1 3.70 16.67 33.33	0 0.00 0.00 0.00	G 5 18.52 83.33 71.43	0 0.00 0.00 0.00	6 22.22
Decision Process	H 1 3.70 20.00 33.33	I 3 11.11 60.00 18.75	0 0.00 0.00 0.00	J 1 3.70 20.00 100.00	5 18.52
Across	3 11.11	16 59.26	7 25.93	1 3.70	27 100.00