Ah-Ha, I Knew It All Along: Differences in Hindsight Bias Between Insight and Algebra Problems

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Abstract

The present study investigated the role of restructuring in the solution of insight and incremental problems. Participants were presented with a series of insight and algebra word problems in a hindsight bias paradigm (Fischoff, 1975). Those who solved the insightful problems correctly showed increases in importance ratings on the key problem components. However, no increases in importance ratings were detected for the key problem components of algebra problems. These results are consistent with theories that propose that representational restructuring plays a fundamental role in the insightful problem solving process (Davidson & Sternberg, 1984; Ohlsson, 1992).

Restructuring and Insightful Problem Solving

A number of researchers have suggested that insight problems may be solved in a qualitatively different manner from incremental or analytic problems (Duncker, 1945, Davidson & Sternberg, 1984, Metcalfe & Wiebe, 1987, Ohlsson, 1992). For example, when Metcalfe and Wiebe (1987) had subjects make feeling of warmth ratings while solving algebra and insight problems, they found that while solving algebra problems, subjects' warmth ratings steadily increased towards the time of solution; whereas during the solution of insight problems subjects' warmth ratings remained low and suddenly increased right before they solved the problem. These results suggest the processes for solving insight problems are different from the systematic or analytical processes used for incremental problems. However, this only represents the *suddenness* of the insightful process and does not shed light on the causes of the solution patterns.

It has been suggested that insight problems differ from incremental problems in that the nature of the solvers' experience causes them to construct a representation of the problem that cannot lead to the correct solution (Duncker, 1945, Davidson & Sternberg, 1984, Ohlsson, 1992). In order to come to the correct solution, solvers must restructure their original conception of the problem. Proposed evidence for restructuring in insight problem solving has come from a wide range of empirical findings. For example, Dominowski and Buyer (2000) found decreases in re-solution time for those who correctly solve insight problems but not for those who were simply shown the answer. Knoblich, Ohlsson, and Raney (2001) analyzed eye movements during the solution of matchstick arithmetic problems and found evidence for impasses followed by increased fixations on components of the problems that were key to solution. Durso, Cornelia, and Dayton (1994) attempted to find an independent measure of restructuring by statistically modeling successful and unsuccessful problem representations after the problem solving session. They found that successful solvers representations centered on concepts key to the nature of the solution, whereas non-solvers representations centered on the principle characters in the story problem, which were not relevant to the solution.

These empirical studies suggest an insight problem solving process that involves the restructuring of the mental problem representation. However, these studies fall short of proving the existence of a restructuring process because they fail to directly measure representational change before and after solving across an individual and fail to compare problems that involve incremental solutions to the problems proposed to elicit insightful solutions. What is needed is an independent measure of restructuring in order to test theories that predict an insight process involving restructuring against theories which do not predict restructuring in any problem solving process (such as Weisberg's nothing special view, 1986). Furthermore, this method must be able to directly test whether more restructuring is involved in insightful than incremental problem solving. The present study uses a hindsight bias paradigm to produce an independent measure of the amount of restructuring involved in solving different types of problems.

Hindsight Bias

Hindsight bias is the observation that people with outcome knowledge of a situation falsely believe that they would have predicted the correct outcome (Hawkins & Hastie, 1990). Fischoff (1975) originally developed the basic paradigm. He had people read a narrative of a situation with or without receiving the outcome and then had them rate the probability of alternate outcomes as if they had no knowledge of the outcome. The general finding is that people with outcome knowledge unknowingly rate the outcome they were told as more probable than alternatives, as if they "knew it all along." Individuals who receive outcome knowledge also rate the sentences in the narrative that support the given outcome as more important than those that do not, even though they are asked to ignore the given outcome. This same effect has also been shown in within-subject studies in which participants are asked to rate outcomes before they receive outcome information, and then asked to reproduce their original questionnaire ratings after receiving outcome information (Fischoff & Beyth, 1975). Most research suggests that hindsight bias is not due to motivational factors but involves cognitive processes that automatically restructure one's situation representation to accommodate the new information, leaving individuals unable to access or reproduce their original representation (Hawkins & Hastie, 1990).

This leads to the hypothesis that processes that cause more restructuring will lead to more hindsight bias. Restructuring theories of insightful problem solving make clear predictions about the nature of hindsight bias for insightful problems. If correctly solving insight problems involves restructuring of the problem space to come to a solution, then those who correctly solve insight problems should show hindsight bias on the problem components that are key to solution. However, those who fail to correctly solve the insight problems should not show any hindsight bias on those components.

If this restructuring occurs only as a result of an insightful problem solving process, then being shown the solution should not lead to hindsight bias of a similar nature to those who solve on their own. Algebra problems should be solved in an incremental fashion. Therefore, restructuring theories of insightful problem solving would predict no hindsight bias on the key components of algebra problems regardless of correctness of solution or being shown the answer. Finally, the "nothing special" or gradual transformation theory of insightful problem solving (Weisberg, 1986) predicts no differences in between insightful and incremental solution processes. Therefore, this theory would predict no difference in hindsight bias between insight and algebra problems or those who come to solution, and those who do not come to solution but are shown the correct answers.

The present study consisted of two sessions. Participants received a series of insight and algebra word problems. During session one, Ss first were asked to read through each problem carefully and rate each component of the problem on its importance in finding the solution. Then they were asked to attempt to solve each problem. Following the solution phase approximately half the Ss were shown the correct solution. After a one week interval Ss returned for the second session. At this time they were asked to attempt to remember their original importance ratings for each of the problem components. Hindsight bias was measured as the change in importance ratings between the two sessions, in favor of relevance for solution.

Methods

Participants. One hundred twenty eight introductory psychology students participated in this study to fulfill a class requirement. They were run in groups of 3 to 12.

Design. This study consisted of two one-hour sessions separated by a one-week interval. During the first session Ss rated the importance of the problem components of several insight and algebra problems. Next they attempted to solve each problem. After attempting to solve, half the groups were shown the solution. After a one-week interval Ss returned and were asked to reproduce their original component importance ratings. This resulted in a 2 session rating (session 1, session 2) X 2 shown answer (Yes, NO) X 3 solution type (no solution, incorrect, correct) X N components (varies by problem) mixed design. Session rating and problem components were within-subject variables, while shown answer and solution type were grouped between subjects.

Materials and Procedure. Participants completed the S1Q booklet first. The S1Q booklet consisted of six insight problems and four algebra word problems. Ss were instructed to carefully read each problem, but not to attempt to solve the problems. Instead, Ss were asked to rate each sentence or component of the problem on how important it is in finding the solution to the problem. Each sentence or component of the problem was listed one at a time followed by a rating scale that consisted of a 7.3 cm continuum. The far left side of the continuum was marked as representing "very unimportant," while the far right side was marked "very important." Participants were instructed to make a mark anywhere on the continuum that best represented their opinion of the particular problem component. Participants were allowed to work through the questionnaire booklet at their own pace but were allowed no more than 15 min. to complete all the ratings. The experimenter periodically reminded participants not to attempt to solve the problems throughout the rating phase. These ratings are the session 1 importance ratings.

Next participants completed the problem-solving packet (S1S). The S1S booklet presented the same 10 problems, each on its own page. Ss were instructed to attempt to solve each problem and that they would be given three minutes to complete each problem. The directions instructed the Ss to show all work, circle their final answer, and if necessary explain the solution using a few short sentences. Ss were instructed to work through the booklet in order, stop working on a problem at the experimenter's signal, and wait until the experimenter's signal to begin the next problem. Ss were given 3 min. to work on each problem. The Ss performance each problem was used to assign participant into one of three solution type groups (no answer, incorrect, correct) for each problem.

After attempting to solve all the problems, half of the groups were dismissed (shown answer no). The other half (shown answer yes) were shown step-by-step outlines of the solutions of each of the problems on an overhead projector. The experimenter read a script that explained each answer. Each problem explanation took approximately 1 min. At the conclusion of session 1 Ss were asked not to discuss the details of any of the problems they saw or their solutions with anyone else in the Subject Pool and dismissed.

Session 2 occurred exactly one-week later in the same room at the same time. Ss were first issued the second session questionnaire packet (S2Q). This packet was identical to the first except that the participants were asked to attempt to reproduce their exact component importance ratings from the first experiment. These ratings are the Session 2 importance ratings. They were once again allowed to work through the booklet at their own pace but had no more than 15 min. to complete the entire memory test. Then, Ss once again attempted to solve each problem in the same manner as in session 1. Finally, participants were debriefed as to the nature of the study and once again asked not to discuss the study, problems, or solutions with anyone else in the Subject Pool.

Table 1: Number of Participants Per Cell by Problem.

	Shown Answer Yes			Shown Answer No			
Sol. type	NA	IN	CO	NA	IN	CO	Total
Train	14	27	30	11	16	30	128
Age	20	25	26	18	20	19	128
Triangle	22	23	26	20	17	20	128
Cups	6	23	24	11	26	25	115*

Note: NA = No Answer; IN = Incorrect; CO = Correct

* 13 Ss had to be dropped from this problem for missing data and/or marking the top importance level for all components on both sessions.

Results

Two algebra and two insight problems from the set of problems were chosen for the problem component analysis. These problems were selected on the basis of two criteria. The first criterion was due to a conceptual constraint. Each problem component or individual sentence had to contain only either information that was key to the solution or not. In other words, any one component of a problem must have been mutually exclusive from the other components and contain unique information that was only interpretable as important or unimportant depending on one's interpretation of the problem. The second constraint was a practical constraint. Each problem had to result in a moderate solution rate such that there would be a number of individuals in each of the solution type groups, and result in a similar number of individuals for each solution type across "answer shown" groups. The two insight and two algebra problems that best met these criteria were selected for analysis. The problems are presented in Figures 1-4, problem components are indicated by lower case letters. The number of participants in each cell for each problem is listed in Table 1.

Problem Component Ratings Problem component scores were coded by measuring the distance of the participants' mark on the continuum from the left end with a ruler. Lower scores indicate that a sentence or component in a problem was perceived as of little importance toward the correct solution, while higher scores indicate that a sentence or component in a problem is perceived of great importance in coming to the correct solution. Hindsight bias is the increase of an individual's importance rating for a solution-related problem component between the first and second sessions.

Restructuring theories of insightful problem solving predict that on insight problems, initial component importance ratings should reflect solvers' activation of an inappropriate problem representation. Those who overcome the impasse and correctly solve the problems need to restructure their representation of the problem to activate the correct operators or components for solution. This new representation should lead to hindsight bias in the importance ratings for the key components of the problem.

Those who fail to solve the problem should show no hindsight bias for key problem components, and may even increase their importance ratings for the original inappropriate components of the problem. In algebra problems no restructuring of the problem representation is necessary to come to solution, therefore no change in representation of the problem should be evident in the hindsight bias measures of algebra word problem components.

a) Two trains leave the same station at the same time. **b)** Each has enough fuel for a 2000 mile trip. **c)** The trains travel in opposite directions. **d)** One train travels 60 miles per hour, and the other 100 miles per hour. **e)** In how many hours will the trains be 800 miles apart?

Figure 1: Train Problem (Problem Type: Algebra)

a) Ann is twice as old as her son. **b)** They were both born in June. **c)** Ten years ago Ann was three times as old as her son. **d)** What are their present ages?

Figure 2: Age Problem (Problem Type: Algebra)

The triangle shown below points to the top of the page. Show how you can move 3 circles to get the triangle to point to the bottom of the page.

a)O

b)O c) O

d)O e)O f)O

g)O h)O i)O j)O

Figure 3: Triangle Problem (Problem Type: Insight)

The picture below is of six glasses. The first three contain liquid. Describe how you could make it so no two glasses containing liquid are next to each other, while keeping three of the six glasses full. To do this, you are only allowed to move **one** glass.

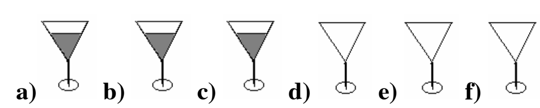

Figure 4: Cups Problem (Problem Type: Insight)

Train Algebra Problem The train problem (see Figure 1) involves constructing and solving equations in order to find how many hours it will take for two trains to be 800 miles apart. To solve this problem one must use information from sentences (components) **A, C, D,** and **E**. These sentences are therefore the *key components* in this problem. To investigate whether restructuring was involved in solving this algebra problem, a 2x5x2x3 (session x component x answer given condition x solution type (no solution, incorrect solution, correct solution)) ANOVA was conducted. Evidence for restructuring as measured by hindsight bias is revealed by interactions involving the session variable. Specifically, an increase in importance ratings on key components across sessions (initial rating vs. second rating) for those who correctly solve the problem is evidence for restructuring.

This analysis revealed a significant session x component x solution type interaction F (8, 484) = 2.69, $p < .05$, $n^2 = .04$. Follow-up analysis revealed that this small interaction was due to significant *decreases* in importance ratings on component **D**, and **E** for those who answered incorrectly and were shown the answer (t (26) = -3.71, p < .01, & t (26) = -2.78, p < .01 respectively). There was also a significant decrease in importance rating on component **E** for those who answered correctly and were shown the solution, t (29) = -3.21, p < .01 (see Table 2). If restructuring of the problem representation was necessary to solve this algebra problem one would expect to see *increases* in importance ratings on components A, C, D and E for those who correctly solve. This was not the case. Clearly there is no evidence of restructuring in those who solved the train algebra problem.

Age Algebra Problem The Ann and Son problem involves constructing equations from the given information to calculate Ann and her son's present age. Sentences (components) **A**, **C**, and **D** are key components for this problem (see Figure 2). To investigate whether restructuring was involved in solving this algebra problem, 2x4x2x3 (session x component x answer condition x solution type) ANOVA was conducted.
This analysis once again revealed a significant session x component x solution type interaction F (6, 353) = 3.35, $p < .05$, $n^2 = .05$. However, follow up analyses revealed no significant differences between session 1 and session 2 ratings for any of the components in any of the groups (see Table 2). This interaction was most likely caused by the trend toward hindsight bias on component **C** by those in the correct solution/not given answer condition, and by a trend towards a *decrease* in importance ratings on component **D** in the incorrect/ shown answer group. However, interaction was small in effect size. These unsystematic trends are weak evidence for restructuring. Therefore, once again, we find no clear evidence restructuring in the solution of algebra problems.

Cups Insight Problem In order to solve this problem, one must pick up the glass in position **B** and pour the liquid into the cup in position **E.** Therefore, **B** and **E** are the key components of this problem. The insightful process theories would predict that the initial representation should be biased against viewing cup **E** as being key in finding the correct solution. This leads to the prediction that importance levels should increase for the two key components for those who correctly solve, while those who do not correctly solve should not show hindsight bias on only the two key components.

To investigate whether restructuring was involved in solving this problem, a 2x6x2x3 (session x component x answer condition x solution type) ANOVA was conducted. This analysis revealed a significant session x component interaction, F (5, 545) = 4.7, $p < .05$, $n^2 = .02$. Follow-up analysis revealed significant increases in importance ratings for both key components **B** (t (119) = 3.85, $p < .05$, $n^2 = .11$) and **E** (t (119) = 2.10, $p < .05$, $n^2 = .03$) across all participants. Even though a survey of the means (see Table 4) gives the impression that the groups that solved the problem correct are driving this effect, a significant interaction involving solution type was not detected. This result tends to follow the predicted pattern of hindsight bias that would be expected with regards to restructuring accounts of insightful problem solving, and stands in contrast to the algebra results that showed no evidence of restructuring.

Triangle Insight Problem To solve this problem, one must move the corner three circles around one position in order to make the triangle point down. The insightful process theories would predict that the initial representation should be biased towards viewing the array as a triangle and therefore solvers will inappropriately view the point of the triangle, or the top three circles, as more important. In order to solve, individuals will need to restructure their representation of the middle circles of the triangle as invariant whether the triangle points up or down. Therefore, the corner circles **A**, **G,** and **J**, are the key components for solving the problem (see Figure 3).

To investigate whether restructuring was involved in solving this insight problem, a 2x10x2x3 (session x component x answer condition x solution type) ANOVA was conducted. This analysis revealed a significant session x component interaction, F (9, 1098) = 4.05, $p < .05$, $n^2 = .03$; a significant session x component x answer condition interaction, F (18, 1098) = 2.04, $p < .05$, $n^2 = .01$, and a significant session x component x solution type interaction, F (18, 1098) = 1.91, $p < .05$, $n^2 = .03$. Follow-up analysis found significant increases in importance ratings, or strong positive trends, on each of the key components for those who successfully solved the problem regardless of whether they were shown the answer (see Table 5). This evidence supports the idea that those individuals who solved correctly had a different (more appropriate) problem representation on their second encounter with the problem.

Other significant increases were found on components **D** and **E** (both unimportant for finding correct solution) for those who came to no solution and did not receive the answer. In the groups that received the answers but did not find the correct solution, increases in importance ratings were detected on the entire bottom row of circles

(**G** through **J**). These findings suggest that being shown the solution to an insight problem can lead to a shift in representation. However this shift is not exclusive to the key problem solving components.

Discussion

These results suggest that hindsight bias can be used as an independent measure of the restructuring involved in solving different problems. These results demonstrate some of the characteristics predicted by insightful problem solving theories that involve mechanism of sudden restructuring of one's problem representation in order to come to solution (Duncker, 1945, Davidson & Sternberg, 1984, Ohlsson, 1992). Although all of the predicted interactions on insight problem component ratings were not found to be significant, there was evidence of an increase in importance ratings on key components in insight problems and not on algebra problems. Also there was evidence that these increases in importance ratings occurred in groups that had successfully solved the insight problem, regardless of whether they were shown the correct solution. The results on the insight problems contrast with those for the algebra problems, which showed little evidence of any increases on importance ratings on the key components. In examining the results it is clear that individuals initially were able to recognize which components of the algebra problems were key in solving the problem. However, even though all individuals were able to correctly report the importance of the key components, many still failed to correctly solve the algebra problems. This suggests that the locus of difficulty for the algebra problems did not lie in the representation.

While all the predicted interactions on the insight components were not found, it is helpful to keep in mind that this was a very stringent test for hindsight bias. The participants in this study were not asked to re-rate the questions during the second session of the experiment. They were asked to "reproduce" or remember their original ratings. It has been estimated that 2/3 of participants are actually able to remember their original rating in this type of within-subjects design (Fischoff & Beyth, 1975). Even though steps were taken to prevent this (ex. rating were done on continuums instead of Likert scales, one full week between sessions) this surely may have affected the final outcome. Also, all theories of insightful problem solving agree that restructuring is far more likely when subjects are naïve to the problems. In this design there was no way to separate out those who had experience with the problems and were able to solve through some other method than restructuring (i.e. memory search). On the same note, it may be possible that individuals did not have the expertise in algebra to solve the problems in a totally incremental fashion. In this design there was also no way to separate out those who experienced *partial insights* while solving the algebra problems (see Ohlsson, 1992). These factors may have also confounded the hindsight bias results. Despite all of these issues, there was clear evidence for differential amounts and patterns of hindsight bias between insight and algebra problems. Currently we are in the process of conducting more detailed studies using the hindsight bias paradigm on a wider range of problems, as well as using this method to investigate the role of impasse in the insightful problem solving process.

Acknowledgements

This research was completed as part of a Masters degree requirement at the University of Illinois at Chicago. Special thanks to Thieu Dang, Trina Kershaw, Amy Brodhead, Josephina DeAnda, Monica Nemiec, and Yessenia Cervantes for the assistance in running participants, and coding/entering data.

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Table 2: Train Algebra Problem: Mean (SD) Importance Ratings by Session, Answer Group, and Solution Type

	Shown Answer Group						Not Shown Answer Group					
Sol.	No Answer		Incorrect		Correct		No Answer		Incorrect		Correct	
Sess.	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
A*	4.6(2.2)	4.9(1.9)	5.7(2.0)	5.3(2.0)	5.8(1.3)	5.8(1.8)	6.2(1.1)	5.4(1.9)	6.1(0.8)	5.5(1.7)	5.7(1.9)	5.8(1.7)
B	4.1(2.1)	.8(2.4)	3.3(2.5)	3.6(2.4)	3.3(2.5)	3.2(2.5)	3.5(2.8)	3.8(2.8)	3.6(2.9)	4.4(2.6)	2.9(2.6)	2.3(2.2)
C*	2.8(2.3)	3.9(2.6)	4.3(2.4)	4.1(2.4)	5.3(2.0)	5.0(2.1)	4.2(2.9)	5.5(1.5)	4.6(2.0)	5.3(1.6)	5.4(2.1)	4.8(2.4)
D*	6.1(0.7)	5.9(1.0)	**6.8(0.3)**	**6.3(0.7)**	6.5(1.0)	6.4(0.6)	6.3(1.7)	6.6(0.5)	6.4(1.0)	6.1(1.0)	6.5(0.5)	6.4(0.6)
E *	5.7(1.4)	5.2(1.8)	**6.5(0.7)**	**6.1(0.8)**	**6.4(0.8)**	**6.1(1.0)**	6.2(1.2)	6.5(0.7)	6.2(1.1)	5.9(1.0)	6.3(0.9)	6.3(0.9)

Note: Bold-faced cells denote a significant difference between the importance ratings on session 1 (S1) and session 2 (S2), $p < .05$. Asterisk (*) indicates key component.

Table 3: Age Algebra Problem: Mean (SD) Importance Ratings by Session, Answer Group, and Solution Type

	Shown Answer Group						Not Shown Answer Group					
Sol.	No Answer		Incorrect		Correct		No Answer		Incorrect		Correct	
Sess	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
A*	6.6(0.5)	6.0(1.3)	6.3(1.1)	6.3(0.8)	6.3(0.7)	6.3(0.6)	6.3(0.5)	6.2(0.6)	6.4(0.8)	6.2(0.8)	6.5(0.8)	6.6(0.5)
B	1.5(1.5)	2.2(2.0)	2.1(2.0)	1.8(1.9)	2.3(2.2)	2.2(2.2)	2.5(2.0)	3.1(2.7)	1.7(1.7)	2.1(2.2)	2.4(2.4)	1.6(2.1)
C*	6.3(0.7)	6.1(0.7)	6.3(1.0)	6.3(0.9)	6.2(0.8)	6.3(0.7)	6.2(0.6)	6.0(1.0)	6.4(0.7)	6.3(0.9)	*6.3(0.8)*	*6.6(0.5)*
D*	5.6(2.0)	5.2(1.8)	*6.1(1.1)*	*5.6(1.8)*	5.7(1.5)	6.1(0.8)	5.5(1.8)	5.8(1.5)	6.0(1.3)	5.9(1.3)	6.4(0.7)	6.5(0.6)

Note: No significant difference between the importance ratings on session 1 (S1) and session 2 (S2) were detected, $p < .05$. Italics indicates trend toward significance $p < .08$, $n^2 > .10$. Asterisk (*) indicates key component.

Table 4: Cups Insight Problem: Mean (SD) Importance Ratings by Session, Answer Group, and Solution Type

	Shown Answer Group						Not Shown Answer Group					
Sol.	No Answer		Incorrect		Correct		No Answer		Incorrect		Correct	
Sess.	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
A	4.1(2.3)	4.1(2.3)	**4.2(2.3)**	**3.4(2.7)**	3.8(2.5)	3.5(2.8)	4.1(2.4)	5.2(1.0)	3.6(2.5)	4.0(2.6)	3.6(2.5)	3.8(2.7)
B*	5.4(1.2)	5.6(1.1)	*5.0(2.1)*	*5.9(1.3)*	5.7(1.8)	6.1(1.2)	5.1(1.8)	5.4(0.7)	5.5(1.9)	5.9(1.4)	**5.3(1.8)**	**6.3(1.0)**
C	4.2(1.7)	4.1(2.0)	3.9(2.0)	3.6(2.4)	4.3(2.3)	3.9(2.6)	5.9(0.2)	4.9(1.7)	4.3(2.3)	4.5(2.5)	3.5(2.4)	3.8(2.6)
D	4.5(1.4)	4.5(1.8)	3.7(2.2)	3.8(2.3)	3.6(2.5)	3.5(2.5)	3.8(1.9)	3.5(1.9)	3.4(2.3)	3.1(2.2)	3.5(2.2)	3.3(2.5)
E*	*4.2(1.5)*	*4.9(1.6)*	4.1(2.1)	4.5(2.1)	4.6(2.3)	5.3(2.1)	4.4(1.7)	3.9(1.9)	4.4(2.2)	4.2(2.2)	**4.3(2.1)**	**5.8(1.6)**
F	4.0(1.9)	4.5(1.8)	3.7(2.3)	3.7(2.4)	3.5(2.3)	3.5(2.5)	3.4(2.2)	3.1(1.7)	3.3(2.4)	3.3(3.4)	3.9(2.1)	3.5(2.5)

Note: Bold-faced cells denote a significant difference between the importance ratings on session 1 (S1) and session 2 (S2), $p < .05$. Italics indicates trend toward significance $p < .08$, $n^2 > .10$. Asterisk (*) indicates key component.

Table 5: Triangle Insight Problem: Mean (SD) Importance Ratings by Session, Answer Group, and Solution Type

	Shown Answer Group						Not Shown Answer Group					
Sol.	No Answer		Incorrect		Correct		No Answer		Incorrect		Correct	
Sess.	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
A*	5.7(1.7)	6.0(1.9)	5.6(2.2)	6.0(1.4)	*5.3(1.6)*	*6.0(1.2)*	5.0(1.9)	4.8(2.3)	5.7(1.7)	6.0(1.2)	**5.3(1.9)**	**6.3(0.8)**
B	5.4(1.8)	5.0(2.1)	5.0(2.4)	5.4(1.9)	3.6(2.1)	3.3(4.5)	4.2(2.0)	3.8(2.4)	5.2(1.6)	5.0(2.1)	4.0(2.4)	3.5(2.5)
C	5.4(1.6)	5.1(1.9)	5.0(2.5)	5.2(2.0)	3.7(2.1)	3.4(2.5)	4.4(2.0)	3.7(2.3)	5.3(2.1)	5.2(2.0)	**4.3(2.1)**	**3.4(2.5)**
D	3.8(2.3)	3.7(2.4)	3.2(2.3)	3.0(2.2)	3.1(1.9)	3.3(2.5)	**3.3(2.0)**	**4.4(2.3)**	3.6(2.3)	3.9(2.4)	3.1(2.2)	3.1(2.5)
E	3.2(2.3)	4.0(2.4)	2.4(2.3)	3.1(2.4)	3.5(2.3)	3.1(2.5)	*3.1(2.0)*	*4.3(2.4)*	3.9(2.4)	3.5(2.5)	3.0(2.1)	3.0(2.5)
F	4.0(2.2)	4.2(2.4)	3.1(2.6)	3.7(2.5)	3.6(2.2)	3.5(2.6)	3.6(2.3)	4.5(2.3)	3.5(2.3)	4.1(2.4)	*3.7(2.4)*	*2.9(2.5)*
G*	**3.5(2.4)**	**4.8(2.0)**	**3.3(2.6)**	**4.5(2.1)**	**5.1(1.8)**	**6.0(1.2)**	4.4(2.2)	4.2(2.3)	4.1(2.4)	3.7(2.3)	*4.7(2.1)*	*5.7(1.7)*
H	**3.1(2.4)**	**4.5(2.3)**	3.4(2.6)	4.1(2.3)	3.5(2.0)	3.2(2.5)	4.1(2.1)	4.0(2.5)	4.2(2.4)	4.0(2.5)	3.7(2.2)	3.0(2.5)
I	*3.1(2.3)*	*4.1(2.4)*	*3.2(2.6)*	*4.3(2.3)*	3.7(2.2)	3.1(2.4)	4.0(2.1)	3.9(2.3)	4.1(2.4)	4.0(2.5)	3.8(2.2)	3.0(2.5)
J*	**3.4(2.5)**	**4.8(2.0)**	*3.6(2.6)*	*4.5(2.0)*	**4.9(1.8)**	**6.0(1.3)**	4.6(2.2)	4.3(2.3)	3.9(2.4)	4.4(2.4)	**4.9(1.9)**	**5.8(1.5)**

Note: Bold-faced cells denote a significant difference between the importance ratings on session 1 (S1) and session 2 (S2), $p < .05$. Italics indicates trend toward significance $p < .08$, $n^2 > .10$. Asterisk (*) indicates key component.