Center for Open Access in Science ▪ https://www.centerprode.com/ojer.html
Open Journal for Educational Research, 2019, *3*(2), 39-52.
ISSN (Online) 2560-5313 ▪ https://doi.org/10.32591/coas.ojer.0302.01039h

Organizational Processes of Problem Solving Groups

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Received 13 March 2019 ▪ Revised 30 June 2019 ▪ Accepted 19 July 2019

Abstract

The purpose of this study is to examine organizational decision-making processes of problem-solving groups. This experimental design study utilized a case study method bounded by a fictional problem-solving scenario to illicit problem solving in groups. Fourteen undergraduate pre-service teachers were placed into six groups and given 45 minutes to create a collaborative solution to the problem-solving scenario. Data sources consisted of group observations and focus group interviews. Data were analyzed using an inductive thematic technique. Results indicated seven themes that illuminate the nature of the group's organization of cognitive processes and possible solutions. The results of this study may help understand how groups organize information, solutions, and cognitions in a complex group decision-making environment.

Keywords: group problem-solving, decision-making, judgement, complex problem-solving, simulated knowledge.

1. Introduction

In corporate business, education, or military, problem solving and decision making are commonly done in groups (Gupta, 2012). It is widely believed that group problem-solving and decision making is more efficient and optimal than individual problem solving because groups can process more information than an individual can (Stewart & Stasser, 1995). Groups also facilitate discussion and debate that result in complex and rich decisions (Davis, Stasser, Spitzer, & Holt, 1976). Indeed, in many instances, group work is used because collaborative problem-solving is perceived to produce solutions that are more objective and "fair", as groups are more resistant to bias than individuals, even to the extent that group members show bias towards information that supports their decision after the problem-solving task (Stasser & Titus, 1987). Past studies (Engelmann, Tergan & Hesse, 2010; Stasser & Titus, 1987; Stewart & Stasser, 1995, 1998) have contributed to understanding how collaborative groups solve problems, but the literature does not examine the phenomenon of how group members organize their cognitions and decision-making processes during the problem solving activity. Thus, the purpose of this study is to examine the mechanism by which groups organize their cognitive processes and problem solutions to solve problems, in order to begin to address this gap in the literature.

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1.1 *The importance of collaboration in learning activities*

Collaboration expands human capabilities by allowing multiple individuals to augment the knowledge of others with their own to increase the learning of all group members above what could happen if all group members worked individually (Wertsch Del Rio & Alvarez, 1995). This enhances capabilities of the team as a whole and can diminish individual weaknesses (Wallace & Hinsz, 2010), and the discussion and debate inherent in collaborative activities result in complex and rich decisions (Davis et al., 1976). Not only are decisions made richer by collaborative activities, but if used in a learning context, problem solving can be more effective when individuals are given the opportunity to discuss their ideas and perspectives (Pena-Shaff & Nicholls, 2004). Moreover, working and learning in groups increases memory functions because team members can provide clues when others in the group forget critical information (Artman, 1998; Fiore et al., 2010; Rentsch, Mello & Delise, 2010).

- Collaborative groups organize their processes to solve problems.
- Collaborative groups utilize transitive memory systems to process possible solutions.
- Conflict is important to refining potential problem solutions.
- Leadership acted as a source of problem-solving organization.
- Novice knowledge is often shared as if it is expert knowledge, in problem-solving.

1.2 *Information organization in collaborative groups*

Information processing in collaborative groups involves sharing, encoding, storing, and processing solutions and objectives of information available to the team (Wallace & Hinsz, 2010). Inherent in collaboration is the complexity of the requirement to synchronize multiple individuals' processes in a way that group decisions can be made more complex and richer (e.g., Davis et al., 1976; Pena-Shaff & Nicholls, 2004). The knowledge-building process is driven by the integration of information that has been organized in a way that is meaningful in a particular context (Fiore et al., 2010). Inherent in collaborative processing is the complexity of the requirement to synchronize multiple individuals' cognitive processes. Synchronizing the cognitive processes of group members necessitates the awareness of several different collaborative processes (Gross, Stary & Totter, 2005).

In other words, in order to complete a knowledge-building process in a collaborative environment, individuals must have awareness of multiple different happenings in the decision-making context. Gross and colleagues (2005) organized these types of awareness into two groups: cognitive awareness (i.e., group awareness, task-specific awareness, and situation awareness) and social-based awareness (i.e., social awareness and objective self-awareness) (see also Jongsawat & Premchaiswadi, 2011).

Once a problem-solving team understands the problem constraints and goals and selects a strategy, a division of labor must take place to ensure that the work necessary to create a solution happens (Wallace & Hinsz, 2010). Because division of labor forces order, it can be considered as a form of organization. Without attending to labor tasks, groups may operate in an unorganized fashion by duplicating work or missing critical steps.

1.3 *Transfer of information*

Division of information is important to the success of collaborative groups if innovative knowledge is to be created (Rentsch, 2010). In decision making or problem solving, the presence or absence of information shapes the outcomes or solutions the group produces. For example, groups will fail to discuss an item only if all members fail to mention the item (Stasser &

Titus, 1987; Stewart & Stasser, 1995). An informed minority is a sub-set of a group that holds unique (in relation to the group) information (Stasser & Titus, 1987). Previous research indicates that having at least one member with functional expertise compensates for other members' lack of expertise. This is true only if (a) the expert knowledge is accurate, (b) group members recognize the expertise of the informed member, and (c) the informed member is able to transfer the information to the group (Stewart & Stasser, 1998). It is important to state that knowledge transfer between individuals is useful only when it is externalized in a manner that imparts understanding to the recipient so that the recipient can make sense of it in order to internalize the information (Rentsch, 2010).

1.4 *Purpose of the study*

The complex nature of many problem-solving activities often necessitates group solutions. Although much research has been conducted regarding the benefits of participation in collaborative problem-solving activities (e.g., Engelmann, Tergan, & Hesse, 2010; Stasser & Titus, 1987; Stewart & Stasser, 1995), little is known about how groups organize their cognitions and decision-making processes during the problem-solving activity. Thus, the purpose of this current study, is to examine the mechanisms used by problem solving groups to organize their cognitive processes and problem solutions, in order to solve complex problems. It is through this understanding that we may be able to fashion interventions to facilitate more efficient group collaboration.

2. Methods

A general qualitative design was used to observe five groups bounded by simulated expertise. All participants were given an information sheet about the study and provided consent prior to the beginning of the study. Each participant received prompts that included knowledge that simulated expert and novice knowledge structures (Ericsson & Smith, 1991) to simulate the difference in knowledge of group members in real-world problem-solving activities (Table 1). Each group member simulated expert knowledge was presented organized in a table that was easy for participants to read (Appendix C). Expert knowledge consisted of facts that could be used to create a problem-solving solution. Group member novice knowledge was presented in paragraph form, and consisted of assumptions, and speculation that the problem-solving group could use to create a problem-solving solution (See supplemental material). Each participant knew that the group held different knowledge sets but did not know which ember had novice or expert in each area. The scenario area consisted of fictional people, places, and events in order to limit the participants' abilities to use pre-constructed knowledge. Controlling the levels of expertise was necessary to observe the processes of the group without other factors (e.g., improper knowledge representations or social/economic prior knowledge) breaking the boundaries of this case (Shin, 2003; Stewart & Stasser, 1995, 1998). Without this bounded system, group members would be able to use prior knowledge to solve the problem without collaborating with other members (Jonassen, 1997), thereby negating the purpose of the observation.

The problem-solving task for this study was written so that the participants could view multiple solutions as correct. The task was written in this manner in order to make the task complex enough that group problem solving is necessary (Baxter & Ward, 1976; Fiore et al., 2010). The problem contains enough structure to not be considered ill-structured, but it is ambiguous enough that the participants must choose through multiple possible decisions (Ge, 2003; Jonassen, 1997). The problem-solving task was written in a way that it was difficult enough to evoke not only problem solving but group problem solving. In the case of problem-solving tasks that are not difficult enough, one participant may be able to create a solution on his or her own (Rajaram, 2011).

2.1 *Participants*

Participants (n=14) consisted of pre-service teachers at a large research-based university in the southwestern United States. Participants were recruited using a direct contact method from a research participant pool, participants where compensated with course credit. Participants were randomly assigned to group.

Participants were selected using a criterion sampling method, all participants were chosen from a single group (pre-service teachers) from the same university. This method was necessary, in order to minimize differences between group members, which maximizes my ability to make comparisons between groups (Teddlie & Yu, 2007). It was also important for the participants to be similar in order to minimize effects outside of the study. For example, students in a communication program or business program may have formal training in group problem solving that the pre-service teachers may not receive. Because all of the participants came from the same program, their educational experiences were similar. The mean age of the participants was 21.21 years (SD = .80). Participants consisted of 13 females (92.9%) and one male (7.17%), six juniors (42.9%) and nine seniors (57.1%). The majority of the participants were Caucasian (n=13), the only other ethnic group represented was African American (n = 1).

Table 1.

Group	Pseudonym	Role	Age	Sex
1	Amy	Project Expert	21	F
1	Sarah	Overall Expert	22	F
2	Randi	Project Expert	21	F
2	Sally	Overall Expert	21	F
2	Betsey	Location Expert	21	F
3	April	Project Expert	21	F
3	Kendra	Overall Expert	20	F
3	May	Location Expert	20	F
4	Cletus	Project Expert	21	M
4	Lilly	Overall Expert	22	F
4	Olivia	Location Expert	22	F
5	Nicole	Project Expert	23	F
5	Sarah	Overall Expert	21	F
5	Mary	Location Expert	21	F

Note: Group 1 consists of two members because one participant did not attend the data collection.

2.2 *Task*

The problem-solving task consisted of a scenario problem (Appendix A) and simulated knowledge sets. The scenario gave the participant all the boundaries and rules governing the participant's actions to solve the complex problem (Appendix A). The scenario required the participant to place three fictional groups (i.e., the Pasdons, Appvals, and Salarians) into areas to live. The groups were also asked to assign tasks to the three groups that are necessary for the survival of all groups. Within the context of the scenario, each group had certain allegiances and conflicts with other groups and each location has drawbacks and advantages. The knowledge set simulated each participant's knowledge about the three groups, the three areas, and knowledge about the tasks that must be completed by the groups (see supplemental materials). The knowledge sets were broken into two different types of knowledge: (a) expert knowledge, and (b) novice knowledge (Appendix C). Three-person groups were randomly assigned to one of the simulated knowledge so that each participant had one expertise (i.e., expertise in projects or expertise in locations) and one participant had expertise in both areas as well as in their knowledge about the groups (Table 1). This was done to ensure that each group had enough expertise in the three knowledge areas (knowledge of location, groups, and projects) to complete the problem-solving task.

Each knowledge set consisted of three areas of knowledge: (a) knowledge about the groups, (b) knowledge about the projects, and (c) knowledge about the locations. The areas of a participant's expertise consisted of factual information arranged systematically in matrix format, free of assumptions. This information was arranged in this manner to represent the quick retrieval nature of expert knowledge, with key facts highlighted for quick identification (Rentsch, 2010). Novice knowledge was presented in paragraph form. Novice knowledge contained facts, assumptions, and incorrect information. This knowledge was spread across different parts of the knowledge sheet. For example, knowledge about the Pasdons that in one sentence presented information on their government may be followed by random facts about the Salarians to simulate the unorganized nature of novice knowledge (Rentsch, 2010). In the knowledge set, highlighted words and headings served as schemata and cued the participant that important information (or, in some cases, assumptions) was present (Mayer, 1983).

The decision matrix is a document where each group recorded their unanimous decisions. Each group was responsible for documenting the rationale and possible negative consequences for the problem solutions they created. Each group had 45 minutes to create a problem solution for every aspect of the scenario. Because the problem-solving task was ill-structured, the groups could theoretically spend a large amount of time debating the relationship between each variable, thus the rationale for the time limit was to focus the participants. If the group failed to meet the 45-minute time standard, they would be given a five-minute grace period to create a solution. Whenever the group agreed unanimously on the solution (by completing the decision matrix), the task was complete. After the task, a focus group interview was conducted.

3. Data analysis

Inductive qualitative analysis key function is to elicit meaning from raw data (LeCompte & Preissle, 1993). This current study utilized a qualitative case study method within a structured problem-solving context. Although unorthodox to utilize qualitative analysis procedures within the framework of an experimental design, this was done for a very practical reason. The phenomenon of interest in this current study is group problem solving. The methods used in this study allowed for a uniform examination of problem solving in a group context while controlling for simulated knowledge. This method of analysis was employed because the phenomenon (organization of problem-solving groups) has not been thoroughly studied and it was appropriate to allow the data to dictate themes rather than forcing meaning based on other theoretical basis.

A thematic method of analysis as outlined by LeCompte & Pressle (1993) was used to analyze group data. Conversations and focus groups were audio recorded and transcripts of these recordings were used for analysis. Analysis resulted in nine data segments, 14 codes, and seven themes (Appendix B). To reduce the data into meaningful divisions, all aspects of data collection were recorded in order to capture the phenomena and any tangible variable that could be noteworthy. Large chunks of data were then broken into smaller pieces that could have meaning on their own (LeCompte & Preissle, 1993). After determining the unit of analysis, segments were created for each group's transcription. Because the group behavior of problem-solving was the same for each group, the segments for each unit of analysis was the same: Defining of problem space, strategy, conflict, dissonance, stating knowledge, seeking confirmation, defining problem space within group (Appendix B). The segmenting processes resulted in a visual representation of the flow of each group's steps taken to create a problems solution. Because the target phenomenon (organization of cognitions, solutions and processes) of interest is largely cognitive and consists of many processes that the participant may not be aware of, the most meaningful data came from the direct observation and was supplemented by the focus group interviews (Anderson, 2010; Morrison, Ross, & Kemp, 2007).

4. Results and discussion

The foundation of this study lies in the assertion that group problem solving involves complex processes and requires organization of group solutions and cognitions. This study sought to examine the organizational processes of problem-solving groups. The examination of qualitative data indicated seven themes elicited from group observations and focus group interviews. These themes represent the sources of problem-solving organization used by the groups in this study and are presented below with supporting quotes from the transcripts.

4.1 *Theme 1. Leadership*

The exhibition of leadership in the group's organization made a difference in the groups' problem solutions. Two of the five groups were led by one participant for the majority of the observations. In group 3, Kendra (overall expert) led the group for 63% of the observation. For example, at the beginning of the problem-solving processes she set the agenda for the group by determining what knowledge every member had by saying, "The first thing I had was the three groups. Did y'all have much on them?" Asking this question prompted the other members to describe their knowledge and evoked the understanding that the knowledge each member holds is essential to the collaborative problem-solving process (Engelmann & Hesse, 2010). Without one participant taking a leadership role, the understanding of each group member's knowledge may not have happened in a direct way.

In these collaborative problem-solving scenarios, leadership is a form of organization because it gives individuals who are not familiar with each other a sense of what is supposed to be done and a possible way that it should be done. When asked how the problem solving process would have been different if they were doing it by themselves, several participants said that they would be frustrated and struggle with direction without the aid of others providing some guidance or assurance. Randi, group 2's project expert, summed this sentiment, "I would have been balled up in the corner if I had to do this by myself there was a lot of information, kinda overwhelming."

The idea that clearly defined leadership facilitates problem solving efficiency is supported by the amount of time each group took to finish the problem-solving task. On average, the two groups with clearly defined leaders solved the problems 10 minutes and 46 seconds faster (i.e., 24:38 to 35:24) than the groups with multiple leaders (see Table 2). In the case of group 5, all three members contributed to leading the group and different agendas were set by all three members. This caused the problem-solving process to drag out to 43 minutes and 45 seconds.

Table 2. Group completion times

Group	**Time to Complete Scenario**
1	34:14
2	31:45
3	17:30
4	27:03
5	43:45

From this data, we can glean that leadership is a form of organization for problem-solving groups. Although none of the groups deliberately delegated leaders, the data showed that groups with some level of leadership from one individual performed the problem-solving task faster than groups having leadership from two or three individuals. From this data, it seems that more formalized positions and roles in groups would facilitate performance on problem-solving tasks.

4.2 *Theme 2. Seeking understanding*

In group problem solving contexts there are multiple problem representations that must be consolidated in order to create a feasible solution. By seeking understanding about the problem, participants can focus on ensuring each group member defines the problem space in a similar manner. When individuals in the groups asked questions to seek understanding, the knowledge gained helped in the organization of the problem and its solution. For example, April, group 3's project expert, clarified the task presented to her group by asking a question designed to seek understanding: "So we are all getting different prompts?" In this case the participant wanted to redefine the problem parameters; if she had not asked the question, her problem space would have been one where all members remained unaware that each member of the team had different knowledge (Anderson, 2010).

The data indicated that individuals create a problem representation and groups must go through a process of creating a shared representation that the entire group can work with (Fiore et al., 2010; Stasser et al., 1989). Problem-solving groups may benefit from an initial conversation that is used to ensure every member has the same problem representations. By doing this, all the cognitive processes can be used to create an optimal problem solution.

4.3 *Theme 3. Conflict*

Conflict as a mechanism to change the opinions of another individual (Papanikolaou & Boubouka, 2011) was also used by participants during this study. This strategy was used rarely, possibly because the stakes of the task were not high enough to elicit conflict between team members (Pena-Shaff & Nicholls, 2004). When two individuals had a difference of opinion, the participants would explain their position and one would ultimately accept the other's position. This is necessary in group problem solving because conflict helps shape the problem solution in instances where there is no clear-cut correct answer (Pena-Shaff & Nicholls, 2004). In this study, group members used conflict to assert a position when they believed an incorrect decision would be made. For example, Amy [Group 1 project expert] presented a solution where the Appvals would work on the dam, but Sarah objected to this solution.

> [Sarah]: Uh, I feel like they would work better together than if we had the Pasdons work with them.
>
> [Amy]: You're saying that it might be a better decision to have them....
>
> [Sarah]: No, I'm saying the rationale like for having these two groups work together is because they are going to work together more efficiently than (the Pasdons).

Amy changed her position, but without the conflict she would likely not have an impetus to modify her position.

The aspect of self-focus or self-awareness is introduced into this theme because each group member had different knowledge, constituting an informed minority (Paulus, 1980). Self-awareness has the potential to create conformity pressure on non-factual knowledge (Paulus, 1980). That is, participants with a different view point will likely conform to the larger group on issues related to knowledge that is not easily confirmed. An example of this self-awareness comes from Mary [group 5, location expert] voicing her concern that placing one group in Throth would be a waste of resources. Because this was a subjective value that could not be easily defended by fact, Mary had a more difficult time defending her position on this issue and ultimately had to confirm with the rest of the group.

4.4 *Theme 4. Confirmation*

The Confirmation theme consists of the act of a group member responding to a query put forth by another team member. This theme is linked with Seeking Understanding because many of the instances of Confirmation come from a participant answering a question from another. One participant seeks understanding from the group and receives confirmation from one of the problem-solving members. An example illustrating this from Group 5 is given below:

> [Nicole, project expert]: Isn't the Salarians the largest [group]?
>
> [Sarah, overall expert]: Yeah.

This simple exchange shows how knowledge seeking and confirmation go together, but also illustrates how confirmation and expertise are linked. Sarah is the overall expert and Nicole knows this so she is going to her to receive confirmation rather than asking a group member who is not an expert in this particular area. In each focus group, participants said that they felt more confident when the expert agreed with their solution. Another example of Conformation came from Group 3 during the focus group, when April responded to questions about how she would characterize the importance of the expert on the team when it comes to organizing your information and whether this would change without the presence of the overall expert.

> [April, project expert]: It's pretty important. I think just having 3 (team members) instead of 2 adds another element and makes you feel more confident with your work…It would have taken longer…I think we would have done a lot more double checking.

Participants' answers indicate that the presence of a content expert allows them to be confident in their decisions. This constitutes a source of organization because expertise in this case is used a decision-making safety check, and in some cases provides the group with the ability to allow a particular decision and move to others.

4.5 *Theme 5. Knowledge dissemination*

The Knowledge theme illustrates the flow of knowledge during the problem-solving process by combining expert and novice knowledge. We initially thought that groups would be successful if the expert is responsible for the most knowledge but the data showed this not to be the case. In fact, only group 2's overall expert disseminated the most knowledge; in every other group, the knowledge disseminator was a person who was not the leader. For example, Kendra was Group 3's overall expert, but she spent most of her time strategizing and leading the team. She accounted for only 27% of the knowledge dissemination in her group as opposed to the 52% disseminated by the project expert. This group still performed very efficiently, finishing the scenario in 17 minutes and 30 seconds (Table 2).

Although participants knew if their information was expert or novice knowledge, most participants still discussed novice information like it was expert information. For example, Nicole in Group 5 was an expert on the projects, but she continually provided novice information about the groups saying things like, "Fairly small and can support many tribes or one small moderate society…" when talking about Tenstal. Sarah, the group's overall expert, corrected this assertion by saying, “Umm, it’s pretty big”. This point gets back to the systematic nature of effective problem-solving groups, by concentrating on her novice information, Nicole left the group open to receiving incorrect information or having the burden of correcting her incorrect assertions (Kirchler & Davis, 1986; Wallace & Hinsz, 2010).

4.6 *Theme 6. Transitive memory*

Transitive memory is a knowledge structure where group members are accountable for only a portion of the knowledge, which diminishes cognitive load and increases the chances that knowledge can be transferred efficiently (Rajaram, 2011; Wallace & Hinsz, 2010). The data shows that participants had to rely on transitive memory systems to transfer knowledge. When an individual is solving problems, it is not necessary to have dialogue, because knowledge is shifting from long-term memory systems to working memory as needed (Anderson, 2010; Mayer, 1983). The process of determining which information to commit to memory by each individual happens overtly. The use of transitive memory is aligned with a systematic process of organization, because the problem-solving group did share the burden of holding certain bits of knowledge rather than conducting a data dump, which would utilize group time resources. When responding to a question in the focus group about how Group 2’s members would solve the problem individually, the following conversation took place:

> [Sally, overall expert]: I think I would use scratch paper a lot more if it was me by myself cause I would have had to figure out what went where and what information made sense together. [laughing]
>
> [Observer]: So you say that you were using the paper to kinda, like, augment your memory? Like, um, you didn’t have to memorize as much because two other people here?
>
> [All Group Members]: Yeah.
>
> [Betsey, location expert]: We would kinda restate it every few seconds. [laughing]
>
> [Randi, project expert]: “It was reassuring and helpful. I would have been way more overwhelmed with all the information I had and splitting it among the three of us.”

Participants’ responses in the focus groups indicate that the problem-solving task was complex enough to elicit group problem-solving, but complex enough that they had to share information visually. None of the groups used a white board or drawing to share information with each other. When participants were asked why they did not use technology to facilitate their problem-solving, every group stated that they did not need to because they constantly shared information and only committed a fraction of the information to memory.

5. Conclusion

The purpose of this study was to explore the mechanisms problem solving groups used to organize their cognitive processes and problem solutions to solve a well-structured, novel problem. Because problem solving activities are often complex, complete solutions are rarely found in isolation, but instead in the context of collaboration. Collaboration within groups is important for finding complete solutions because individual weaknesses can be diminished in a group (Wallace & Hinsz, 2010) and the knowledge of group members can augment that of each individual in such a way that the collective knowledge of the group is greater than that which the individuals would each hold (Wertsch et al. 1995). There has been much examination related to group problem solving (e.g., Englemann et a., 2010; Stasser & Titus, 1987; Stewart & Stasser, 1995), but one area that has not been investigated at length are the mechanisms behind how groups organize their cognitions and problem solutions. Knowing how groups effectively organize their activities to solve complex problems can help other problem-solving groups.

The activities designed for this study were made in such a way as to resemble real world problem solving activities. Although the problem in this situation was well-structured, knowledge sets and expertise of the group members were simulated in such a way that different individuals would have diverse levels of expertise and organization of their knowledge structures. Moreover, a fictional scenario was created to ensure the results obtained from this investigation were not influenced by prior knowledge so the expertise and knowledge structure organization provided to participants would be the driving factor in the organization of problem solutions.

Participants in this study gave evidence of a number of different sources of problem solving organization. The themes presented in this paper provide description of organization in the context of complex group problem-solving. Each theme presents a glimpse into the overall organizational strategies and mechanism that problem-solving groups used in order to complete the complex task. Data from thematic analysis indicated that the groups with a more systematic process of organization conducted the problem-solving task faster and were more efficient, due to the presence of group leadership. The themes of Seeking Understanding, Conflict, Confirmation, and Knowledge Dissemination resulted in a refinement of possible solutions. As group members created possible solutions, the process of conflict, and confirmation resulted in solutions which the entire group agreed with. Transitive memory systems resulted in groups sharing information in a manner that made the use of technology unnecessary. The problem-solving groups generally relied on the expert knowledge structures of their group members rather than presenting knowledge thought the use of graphic or pictorial organizers.

Results of this current study represent a step towards a broader understanding of how problem solving groups organize solutions and cognitive processes. Future investigations should include male participants and those beyond a pre-service teacher sample to extend the investigation of organizational mechanisms that can be used for complex problem solving. Future studies could use either this problem-solving scenario or other scenarios (fictitious or real) to determine if the organizational mechanisms found here can be used in other problem-solving contexts.

Acknowledgements

This research did not receive any specific grant from funding agencies in the public commercial, or not-for-profit sectors.

The authors declare no competing interests.

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Appendix A

Scenario Prompt

Scenario

An accident at a large yield nuclear reactor has left Phidonia inhabitable for the foreseeable future. Phidonia is the homeland of three different nations, who are now left without a home. The Global council has designated a large area of land (now called Alpha Zero) to be the new home for all three groups. The region Alpha Zero has three areas that the groups may live in, and a large water source that will be the location for two large scale projects that are necessary to make Zero Alpha habitable. You have been chosen to serve as part of a three member team to decide which areas the groups will live and what project each group will work on.

Rules:

(1) You are an outsider and hold no allegiance to any of the three groups in this scenario, you are only responsible for making the most logical decisions as you and the team see fit.

(2) Items highlighted in yellow are facts, items highlighted in green are assumptions but also may be erroneous information. Items not highlighted may be either assumptions or erroneous information.

(3) The groups in the scenario are humans like you or me, a military society does not mean that every individual in the society is involved in the military, an industrial society does not only deal in industry they have farms and technology and militaries, etc.

(4) You may verbally share the knowledge you receive from your prompt but you cannot allow others to read the prompt or write information verbatim from the prompt.

(5) The laws of nature (gravity, biology, time etc.) are applicable to this scenario.

(6) Current technology and production capabilities are in effect for this scenario.

(7) The timeline for both projects have been carefully planned, the groups have enough electricity and fresh water to survive until the projects are complete.

(8) Site for dam, and water filtration system has already been chosen.

(9) Projects are already allocated building resources (groups do not have to collect resources to complete the projects).

(10) Groups can work on projects regardless of the location you select for them to live.

(11) At any point you can ask the observer for clarification of any of the rules or guidelines.

(12) You cannot split groups into piece or allocate parts of the group to do anything.

Appendix B

Code Book

Segments

(1) Defining problem space

(2) Strategy

(4) Conflict

(5) Dissonance

(6) Stating expertise/novice

(8) Seeking confirmation

(9) Defining PS within group

Codes	
a. Asking for Confirmation	Attempt of a group member to gain confirmation from another. Or asking a question
b. Assumption	The use of information that is not stated in knowledge set as fact/bringing in personal beliefs into scenario
c. Conflict/conflict	Participant challenges the assertion of another
d. Confirmation	Participant confirms what another says or answers question (Like saying yes)
e. Confusion	Participant gets does not know what's going on "hmm I don't know what's going on"
f. Consensus	Group/individual agrees with assertion of another member
h. Defining problem space	Asking Questions to redefine problem space, can be done by making statements to receive clarity
i. Leadership/Strategy Problem solving	Includes agenda setting, and strategy setting
j. Deducting	Making inferences from observations weather true or not
k. Presenting solution	When a participant presents a possible solution to the group/ when participant provides rationale for matrix it goes here
l. Social Interaction	Interaction between participants outside of scenario, telling jokes, etc.
m. Social facilitators/inhibitors	Motivating factors, i.e. I was thinking that too (can be Very similar to confirmation)
n. Stating Expertise	Stating information from expert section (all participant Y information is expert unless

	assumption) (all participants information about problem space is expert if it is true)
~~o. Stating Knowledge~~	Omitted
p. Stating Noviceness	1. participant states that knowledge is novice, 2. Participant states knowledge that is written assumption
q. Task oriented	Individual attempts to get group back on track when not focused on task
r. Transition	Group moves from one part of problem solving to another overtly
s. Off task	Any behavior that is not on related to problem solving, (talking about school, talking about pets etc.)

Appendix C

Details of Knowledge Sets

Role	Knowledge about projects	Knowledge about locations	Knowledge about groups
Project expert	Expert	Novice	Novice
Overall Expert	Expert	Expert	Expert
Location Expert	Novice	Expert	Novice