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TRAINING PLANNING SKILLS: A COMPARISION OF CASE-BASED AND PRINCIPLE-BASED METHODS

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DEPARTMENT OF PSYCHOLOGY

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Abstract

Leaders must have good planning skills in order to be successful. In this paper, we administer training of planning skills that addresses two major considerations. First, what are the key processes involved in planning. Second, what content do these processes work best in. This paper examines two key processes of planning: forecasting and identifying key causes. Second, this article examines two major forms of content including case-based reasoning and principle-based reasoning. It is concluded that the best process and content depend on the type of outcome desired and the type of individual being trained.

James Webb, administrator of the National Aeronautics and Space Administration (NASA) from 1961 to 1968 is widely considered to be the man who "managed America to the moon" (Lambright, 1990). Working for the Kennedy and Johnson administrations, Webb inherited an agency with a clearly defined goal. This goal, called *Apollo*, was to send a man to the moon and return him safely to Earth. Webb created a plan that mapped out his strategy and approach based on what was required to realize this goal. He knew that to gain support and funding from the current administration, alliances must be forged internally and externally to ensure the financial and political backing he needed. In addition, Webb knew he must secure the administration's support for the program, regardless of a possible shift in administration due to elections. To do this, he decided to dramatically move up the timeline for *Apollo* so the program would not lose momentum and thus the interest of the administration. When the Soviets started to outperform the United States in the Space Race, Webb used this situation as an opportunity to secure a more rapid timeline. Webb's ability to plan, to determine his objectives, pay attention to his environment, and decide what needed close attention, allowed him to succeed at his ultimate goal. In July 1969, America was the first nation to send men to the moon.

James Webb is a prime example of a leader who used superior planning skills to succeed in his leadership role. Leaders must have good planning skills in order to be successful (Marta, Leritz, & Mumford in press). Most often leaders work in complex, ill-defined environments that are constantly changing (Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000). Because of this, leaders need to plan in order to understand their environments and to design strategies that will handle their current situation as well as prepare for changes that may occur (Mumford, Reiter-Palmon, & Redmond, 1994).

Researchers identify planning as one of the most typical mental activities in which to do this (Runco, 1994; Volkema, 1997). Thus, good planning is not simply a product of intuition (Hogarth, 1987; Levitt, 1963). Planning is a complex and intricate process that involves a great amount of deliberate thought (Mumford, Shultz, & Osburn, 2002; Hammond, 1990).

Still, there are those who would debate whether leaders actually need strategic planning skills in their leadership roles. Mintzberg (1997) claims that it is a myth that managers use reflective, systematic planning on their jobs. He and others argue that in most cases there is a large disconnect between plans and actions when managers are in the field (Mintzberg, 1991; Finkelstein, 2002; Bluedorn, 2002). There are two possible reasons why this view exists. One reason may be that leadership is ill defined. Leaders are not necessarily managers (Day, 2001). Leadership roles come with or without authority, whereas managerial roles are defined by the organization. Therefore, it is plausible that managers' actions would not follow their plans due to the likelihood that the plans came from organizational directives rather than themselves.

In addition, researchers may discount the importance of planning in leadership due to the traditional view of planning (Mumford, Dailey, et al., in press). Traditional definitions of planning emphasize the structural nature of a plan (Mumford, Schultz, et al., 2002). This group defines planning as instructions that order the sequence of operations (Miller & Cardinal, 1994). Specifically, this view describes planning as a prepatory strategy for action (Xiao, Milgram, & Doyle, 1997). This leads researchers, who study planning in the field, to equate planning with observable time spent on planning (Mintzberg,1997). With this view of planning, it is not surprising that field

researchers did not find many managers planning on their jobs. However, current theories do not define planning as such a rigid process. Planning no longer has to result in a paper document filled with action steps and timelines. In contrast, researchers now define planning as a goal directed mental simulation of activities and future activities (Mumford, Schultz, et al., 2002; Simons & Gulotti, 1992).

Current research indicates there is a strong link between skills and creative thought (Brophy, 1998; Reiter-Palmon, Mumford, Boes, & Runco, 1997). Research has found that most models of creative thought involve some version of implementation planning (Mumford, Mobley, Uhlman, Reiter-Paulmon, & Doares, 1991). In fact, Berger, Guilford, and Christensen (1957) found measures of planning skills correlated highly to measures of creativity. This relationship suggests that a leader's planning skills may be closely tied to the leader's ability to be creative.

Even though the form and degree to which planning contributes to leadership is debated, researchers agree that good leadership requires good planning. Research indicates that planning is a significant influence on performance (Schwenk, 1995). Benefits of leadership planning can be seen in various settings. Individuals use planning for time management, resource management, prioritization, or mapping of activities (Simons & Gulotti, 1992). In addition, planning influences group performance. Groups use plans primarily to provide structure and coordination in completing the task (Berger & Jordan, 1992). Plans help to assign work to members in groups (Gettys, & Foote, 1994b). Plans also tend to define roles and provide expectations to group members. Planning becomes even more important for groups when goal difficulty and task complexity increase (Weingart, 1992).

Likewise, leadership planning is needed within the organization. Organizations need good planning to survive, grow, and be competitive with other organizations (Miller & Cardinal, 1994). The study of strategic planning comes from this idea that organizations must make strategic long-term plans that consider external influences and restrictions in order to be successful. Rapid changes in technology and markets make planning even more necessary for organizations (Mumford, 2000). Studies suggest that planning influences organizational performance and even shareholder gains (Miller & Cardinal, 1994; Yukl, 2002; Rhyne, 1986). Ultimately, research indicates that leadership performance depends heavily on one's ability to plan (Mumford, Dailey, et al., in press). The intent of this study is to determine whether planning performance can be improved through training.

Planning

Given that planning is such a crucial component of leadership, it is imperative that we define how planning works. One plausible model of planning that explains the complex process is a model suggested by Michael Mumford and his colleagues (Mumford, Schultz, et. al, 2002). This model is presented in Figure 1. According to this model, planning is an information processing activity that seeks an optimal course of action in response to environmental demands.

Mumford (Schultz, et al., 2002) proposes a model of planning that involves several key processing activities. The mapping of these steps can be seen in Figure 1. First, the planner scans his or her environment to assess environmental needs and conditions. Next, the planner identifies the goals he or she would like to accomplish. Then, the planner recalls past cases, action scripts, general principles, and past

experiences that match the targeted goals. The planner identifies key causes and requirements that are acting in these cases (Xiao, et al., 1997). The planner uses these memories to form a knowledge base to provide an initial model, or cognitive map of the situation. The planner uses this model to initiate a preliminary plan.

After an initial plan is developed, the planner must again search for information. This information includes identification of key causes, actions that will affect these causes, possible restrictions of those actions, resources that are needed, and possible outcomes from these actions that must be avoided. The planner will expand the initial plan using this information. After that, the planner will forecast possible outcomes of plan implementation (Noice, 1991). During this process, possible implementation problems are identified and back up plans are created to deal with projected obstacles. The plan is then refined and executed.

Clearly, planning is a complex process that involves many different cognitive steps. Thus, when planning is addressed, two major considerations emerge. First, planning is a skill or active process rather than a tool. In order to plan effectively, leaders must know how to devise a plan and not just know the components of a good plan. Second, these processes must work in some form of content. Accordingly, planning heavily relies on experience (i.e. case-based reasoning) and expertise knowledge (i.e. principle-based reasoning).

Process

Given that planning is comprised of a sequence of complex cognitive activities, it is important to understand the underlying processes that bring about planning. Two key

processes that contribute to planning are identifying key causes and forecasting. These sub-processes contribute to the overall planning process in distinct ways.

Identifying Key Causes. One key component of the planning process is identifying key causes in a given situation. Identifying causes is the process of identifying the important factors and information in a situation that contribute to the status of the situation. Because planners have to deal with a large number of causes working in their environment, effective planners often focus on key controllable causes (Graves, 1985).

Successful leaders can identify important factors that are working in their environment. Often, leaders must work in ambiguous, complex environments (Mumford, Scott, Gaddis, & Strange, 2002; Doerner & Wearing, 1995). Likewise, many leaders must work in crises that are highly volatile in addition to being ambiguous and complex (Looman, 2003). Because of their unstable and potentially hazardous surroundings, it is crucial that leaders are able to minimize complexity and make sense of their environments by identifying the key variables involved (Daft & Weick, 1984). Studies have found that the more uncertain a situation is the more information seeking is required (Daft, Sormunen, & Parks, 1988). Identifying the key causes acting in a situation helps to create an understanding, or cognitive map of a situation (Mumford, Schultz, et al., 2002).

Leaders who accurately identify key causes during planning, are able to plan more effectively. Leaders who use a systematic approach to seeking information versus a trial and error approach increase their planning performance (Van Der Linden, Sonnentag, Frese and Van Dyck, 2001). In addition, leaders using this systematic approach increase their learning for future plans and decrease damaging errors during planning. Errors are avoided because mistakes are less likely to be repeated using a systematic approach (Van

Der Linden et. al., 2001). Additional studies found that increased information seeking increases plan quality (Barr, Stampert, & Huff, 1992). For example, those who identify situational causes can more effectively organize the information they are processing (Thomas & McDaniel, 1990). Also, leaders who identify situational variables create more elaborate plans (Berger & DiBattista, 1992). Put into practice, researchers report that organizational plans, based on more information seeking, result in increased performance and monetary gains (Daft et al., 1988; Thomas, Clark & Gioia, 1993). Finally, the identification of causes increases leader motivation and feelings of control during planning (Doerner and Wearing, 1995).

Given that effective planners identify key causes while they plan, it is important to identify how successful planners perform this process. First, effective planners attempt to identify all causes working in their environment (Isenberg, 1986). Here, leaders must gather and process as much information from their surroundings as possible (Child, 1972). Leaders must consider both internal and external factors acting in their environment (Pattan, 1986). Leaders must identify all causes in order to identify all potential important outcomes.

Next, effective planners focus on important or key causes rather than all active causes in a situation. Leaders must find causes that have direct relevance to their goals and problems (Pattan, 1986). Leaders do this to minimize the complexity of their environment. Research indicates that leaders who focus on too many causes are counterproductive in planning and problem solving (Van Der Linden et. al. 2001, Doerner & Wearing, 1995). In fact, errors in planning may often be due to a failure to reduce the information one is processing (Aneona & Caldwell, 1992).

To extract important causes in a given situation, planners must make several considerations. First, leaders must identify causes that have multiple outcomes. Second, leaders must identify causes that are dependent on one another (Haberlandt & Bingham, 1984). Third, leaders must evaluate causes according to their importance. Effective leaders not only identify important causes working within a situation but controllable causes as well. Successful planners realize that although causes may be important, it is wasteful to focus on those causes if they cannot be changed. Leaders must identify and target manipulatable causes in order to affect change in their environments (Dutton & Duncan, 1987). Finally, effective planners identify causes that may have indirect outcomes. Often, leaders look only at obvious causes and outcomes and fail to consider the less direct or ambiguous ones (Van Der Linden et. al. 2001). Identifying indirect outcomes of causes will help reduce ambiguity and uncertainty in the environment (Dutton, Fahey, & Narayanan, 1983).

Forecasting. The other key component of planning is forecasting. Forecasting involves the prediction of likely outcomes or consequences of plan implementation (Doerner & Schaub, 1994). Forecasting occurs when a leader mentally simulates events that could occur based on that leader's initial plan of action (Mumford, Schultz, et al., 2002). Forecasting creates predicted outcomes that the leader can then evaluate. These evaluations of predicted outcomes, in turn, help to evaluate the initial plan. Runco and Smith (1992) argue that the evaluation of ideas may be just as important as the generation of those ideas. Thus, forecasting plays a critical role in plan evaluation and refinement (Lonergan, Scott, & Mumford, in press; Doerner & Schaub, 1994; Noice, 1991).

Quality forecasting has many positive implications for the planning process. Various studies have found that the quality of plan performance relies heavily on the use of forecasting (Noice, 1991, Mumford, Zaccaro, et. al. 2002). One key benefit that comes from forecasting is a better-refined plan (Mumford, Schultz, et al., 2002). Put simply, the quality of a plan relies heavily on whether the planner has made accurately forecasted outcomes (Hogarth, 1987). Forecasting plays a key role in plan implementation as well (Patalano and Seifert, 1997). In addition, forecasting identifies immediate outcomes that are necessary for long-term strategies (Langholtz, Gettys, & Foote, 1994b). Forecasting also enables a leader to create crucial back-up plans (Zajac & Bazerman, 1991). Furthermore, forecasting helps the leader know what parts of the plan require extra attention during implementation (Aragon-Correa & Sharma, 2003).

Because forecasting is so important to the planning process, it is crucial to identify how successful planners perform this process. Effective planners use several mechanisms when forecasting. One of the primary mechanisms is predicting positive and negative consequences of a plan. Identifying positive and negative consequences allows the leader to compare positive consequences to negative consequences. Comparing these consequences helps to determine the quality of the plan. Plans with more positive consequences than negative consequences are simply better plans. In addition, studies advocate that it is important to not only know the impact of one's plan but to know the popularity or likeability of the plan as well (Lonergan et al., in press). In order for any plan to work, those involved must "buy into" the plan.

Next, effective leaders project short- and long-term goals for plan completion. Although studies have found that most planners focus on short-term goals, it seems more

effective planners use a combination of short-term and long-term goals because it optimizes a plan's utility (Garling, 1994). Clearly, all plans have both short- and long-term outcomes. Often, long-term goals depend on the successful completion of short-term goals. Therefore, in order for the ultimate goals of a plan to be realized, critical short-term outcomes have to be identified (Hayes-Roth & Hayes-Roth, 1979).

A good planner also knows that identifying the attainable long-term outcomes of a plan is crucial to success. It is difficult to assess how a plan will evolve over time due to environmental influences, implementation errors, or emerging needs. Still, a good planner will determine the attainable long-term outcomes from the less attainable ones so that they will know what they can count on occurring and what they can expect not to occur. Knowing what goals are more or less likely helps one to plan better for those goals (Patalano & Seifert, 1997). A long-term goal that is most certain may require little effort and attention. A long-term goal that is uncertain may demand more attention and work to see that it happens. Finally, knowing what long-term outcomes are more likely allows the planner the ability to plan even farther into the future (Mumford, Schultz, et al., 2002). A planner can plan additional strategies based on more certain outcomes.

In addition, effective leaders identify possible restrictions or contingencies that may be placed on a plan. Usually, plans require many elements to come together in a specific way for the plan to work. Plans may only work in certain situations or under certain conditions. Identification of restrictions and contingencies allows a planner to determine what things must be in place for the plan to work and when the plan should be implemented (Garling, 1994). Planners who identify restrictions and contingencies are

able to identify goals that should be postponed until those restrictions and, or contingencies have been handled (Patalano & Seifert, 1997).

Moreover, effective planners identify errors that are likely to occur during plan implementation. Researchers agree that most leaders' plans are prone to error because of their complexity (Doerner & Schaub, 1994). To illustrate, cooking a five course meal for 200 is clearly more complex and prone to error than making a sandwich for one. Error is even more likely for leaders working in dynamic and sometimes hostile environments (Hartman, White, & Crino, 1986). However, errors are not just any problems that a plan encounters. They are mistakes made by the planner or those implementing the plan. For this reason, if errors can be foreseen they can also be avoided because they are controllable. Since error leads to plan delays, failure, or even personal discouragement, leaders are motivated to avoid error (Garling, 1994). Leaders who can identify where problems might occur will also be able to identify areas of their plan that need refinement, extra attention, or back-up plans.

Finally, effective leaders identify areas of a plan that require back-up plans. Patalano and Seifert (1997) suggest that, when used correctly, back-up plans can be the key to a successfully implemented plan. They argue that if a person considers what might occur before plan implementation and makes mental notes of alternative strategies, then that person will have alternative plans mentally prepared when they are needed. This process has been termed predictive coding. Patalano and Seifert go on to argue that if this forecasting, or predictive coding, is not done, then the planner will be too mentally distracted during implementation to consider alternative strategies if something unexpected occurs.

Content

Given that identifying key causes and forecasting are essential processes of planning, how is it that leaders engage in such processes? In other words, in what kind of content do these processes work best? Two content approaches tend to dominate the current planning literature. These content approaches include principle-based reasoning and case-based reasoning (Phye, 1990; Hammond, 1990). Although it is clear that both are used for planning (Kolodner, 1997), it is unclear which content is best for different processes.

Principle-based reasoning. Principle-based reasoning is one viable content approach to planning (Clement, 1989). Principle-based, sometimes called analogical reasoning, is the process of constructing new relational maps and rule systems based on concepts that are extracted from experience (Mumford & Porter, 1999). Individuals using this approach toward planning or problem solving use an integrated system of concepts or rules, also known as schematic knowledge, and apply these concepts to new problems (Reeves & Weisberg, 1994).

Principle-based reasoning is a conscious effort to create a system of general or overarching concepts (Reeves & Weisberg, 1994). To do this, an individual will search a given example and extract important features or principles from that example (Schank & Ableson, 1977). Features are general principles or properties that describe members of a category (Mumford & Porter, 1999). Thus, concepts act to organize these common features and shared principles of events or things. These concepts define categories and inter-relationships between features. Concepts can also be incorporated into a larger

scheme where concepts are mapped to one another and further inter-relationships are explained (Hummel & Holyoak, 1994).

Individuals use principle-based reasoning to create problem-solving plans (Read, 1987). Concepts are extracted, stored, and then applied to novel cases in the form of problem solving and planning (Zook, 1991; Clement, 1989). It is important to note that specific concepts drawn from principle-based reasoning are not tied to one setting and can be applied to scenarios that are unique from the scenario of which it was drawn (Mumford, Blair, &, Marcy, in press). The process of principle-based reasoning takes an underlying conceptual model shaped from familiar sources and maps this model onto unfamiliar territory (Burstein & Adelson, 1990)

For example, Gick and Holyoak (1980) examine how people extract principles from different circumstances and apply them to new problems. In their study, they give participants a military scenario where the general's goal is to capture a fortress in the middle of a country. Although there are many roads that lead to the fortress, they are all mined, so sending large groups by way of these roads is impossible. The participant is then told the method of attack the general chose to solve this problem. After being presented with this scenario, participants were given a problem (Duncker, 1945) where a doctor has a patient with a malignant tumor that can be destroyed with high radiation rays. However the intensity of the rays needed to kill the tumor will kill the healthy tissue as well. Based on the military scenario given, participants were able to extract the principle(s) behind the military attack and create a cancer treatment solution.

Case-based reasoning. Another school of thought, known as case-based planning, maintains that plans are generated based on one's experiences that have been stored in

memory (Hammond, 1990, Kolodner, 1997). Hambrick and Mason (1984) found that executives create plans in line with their past experiences. Case-based reasoning is the process of using one's own memories or past experiences toward solving future problems (Kolodner, 1997). Research has found that experiential cases are used to create new plans (Berger & Jordan, 1992; Hambrick & Mason, 1984). Researchers are beginning to apply this theory to the study of leader planning (Mumford, Dailey, et al., in press).

Hammond (1990) proposes a model of case-based planning that applies case-based reasoning to the planning process. According to Hammond (1990), planners store past experiences in their episodic memory in two categories including goals to be satisfied and failures to be avoided. Planners identify the goals they want to accomplish and anticipate problems that could arise. Then, planners retrieve cases that meet these desired goals and avoid the anticipated failures. Next, case-based planners combine and modify the retrieved cases to better fit the current situation. Planners store this modified case as well as any repairs that were necessary due to plan failure into memory for future use. In this way, planners learn to plan by storing cases that work, those that failed, and why into memory.

Based on these planning processes and content strategies that we have established, the intent of the present study more specifically is to improve leadership planning by contrasting the effectiveness of content as it involves two key processes. Therefore, we will look at case-based and principle-based training and its effect on planning creation taking into account two of the main processes of planning, identifying key causes and forecasting, to see how these affect planning performance in a leadership context.

Training

Given that there are certain processes and content strategies used in planning, what is the best method to train planning skills? Numerous methods are available to train skills (Dobrovolny, 2002). One feasible method to train planning skills is self-directed, programmed instruction (Goldstein & Ford, 2001). Self-directed training allows the learners to progress through training at their own pace. Programmed instruction is simply a systematic way of presenting information to the learners that is usually in a workbook or computer format. Programmed instruction may use several different techniques to present information to the learners (Pieters & Bergman, 1995).

To train planning skills, a viable set of techniques might include a knowledge component, multiple-choice test, self-evaluation, an example of the skill used in reality, and a practice exercise (Goldstein & Ford, 2001). Initially, the knowledge component presents the basic information the learners need to understand and perform this skill (Kontogiannis & Shepherd, 1999). The knowledge component breaks information into small units so that the material is easy to understand and remember. Next, multiple-choice questions ask the learners to recall what they have just learned. These questions serve as a knowledge reconfiguration task. Asking the learners to retrieve and reconfigure information in order to answer the questions, helps the learners further remember what they learned (Dobrovolny, 2002). Following, learners evaluate their answers, which acts as a feedback mechanism. Feedback reinforces correct answers and adjusts incorrect ones. Then, the learners are given an example of a skill applied in a realistic setting. This provides the learners with a concrete illustration of how the skill is used. Finally, the practice exercise prompts the learners to apply the skill to a unique

problem. Allowing the learners to practice the skill engages the learner and encourages them to participate in the learning process (Davidson, Deuser, & Sternberg, 1994).

This approach is particularly attractive for training planning skills. First, because it is a self-paced program, it allows an individual to learn at a rate that is more suited to the individual. Also, the combination of techniques used encourages learner participation and allows the learner to engage in active problem solving (Davidson, Deuser, & Sternberg, 1994). In addition, this method applies to either type of knowledge content including principle-based and case-based reasoning. Finally, a programmed instruction training method is a more realistic approach toward training within organizations. The current trend for most organizations is to use some form of computerized programmed instruction for employee training, such as e-learning. The method discussed above is a method that could easily be found in a computerized setting (Dobrovolny, 2002).

Method

Sample

This study was conducted using a sample comprised of 174 university students from a southwestern state university. Students participated in the study to fulfill their requirement for their introductory psychology course. The sample consisted of 79 males and 95 females. The average age of students was 19.5 years. Mean SAT scores of this study group were 1180 and ACT scores were 24.7.

General Procedure

This study examined two independent variables; training content and training or instructional method. A two by three design was employed. Participants were randomly assigned to one of six conditions. The first independent variable broke training content

into two conditions. Participants were trained on one of two types of planning processes. One group received training on identifying key causes. The other group received training on forecasting downstream consequences. The second independent variable broke training content into three conditions. The training content included a case-based approach, a principle-based approach, and a combination of the case-based and principle-based approaches.

Subjects participated in a four-hour group-testing period. Subjects were asked to complete a variety of paper and pencil items including a set of covariate measures, a pre and post planning test, an instructional packet on planning skills, and a planning task. After the subjects completed the timed measures, they received their training packets and were allowed to complete the remaining items at their own pace. To avoid fatigue, students were encouraged to take breaks at their own discretion.

The experimenter began each session by telling participants that this study would examine the effectiveness of different planning skills as well as compare different ways to acquire those planning skills. At the beginning of each session, the experimenter encouraged participants to be invested in the process. No deception was used for this study.

To begin, participants filled out a biographical information sheet and then completed a number of covariate measures. A total of five covariate measures were administered. Covariate measures included: a measure of verbal intelligence, a measure of divergent thinking, a goal orientation scale, a need for cognition scale, and an educational history scale. Next, participants filled out a pre-test that assesses planning

skills. This pre-test consisted of reading real-life scenarios and answering multiple-choice questions designed to measure various planning skills.

After participants completed the battery of covariate measures and the planning pre-test, participants completed a planning skills instructional packet. Participants were randomly assigned to one of six groups and received one of six different instructional packets. Packets differed in two ways. First, packets trained either identifying key causes or forecasting downstream consequences. Second, packets used a principle-based structure, a case-based structure, or a combination of the two to illustrate the training content.

The packets included an instructional workbook and answer booklet. The instructional workbook was broken down into seven smaller sections or units. Each unit focused on one of seven planning heuristics. A heuristic is a mental aid that simplifies complex concepts (Hogarth, 1987; Mumford & Norris, 1999). For each unit, subjects were asked to read an informational sheet about a particular planning heuristic, answer four multiple-choice questions concerning the information they just read, and check their answers using an answer key. The subjects continued by reading an example of this heuristic applied in a real world setting and then completed a practice exercise. This practice exercise gave the participant a real life scenario and asked the participant to apply the particular heuristic to this scenario.

After completing the instructional packet, participants completed a self-perceived learning measure, a planning task and the planning post-test. The self-perceived learning measure asked the participant six simple questions regarding their opinions of the instructional packet. The planning task presented the participant with a rather extensive

scenario regarding an experimental high school. The participant was asked to create a plan to target the needs of the given scenario. Lastly, the participant completed the planning post-test. The planning post-test assessed the same planning skills in the same way as the planning pre-test but used different scenarios. Upon completion of all the measures, participants were given a debriefing statement to read that informed them of the details of this study.

Covariate Measures

Covariate measures were administered to control for or identify various extraneous effects. A total of five covariate measures were administered. Two measures were given to account for cognitive influences and three were given to account for personality influences. The following are descriptions of the measures that were used to identify extraneous factors.

To assess differential cognitive influences, two covariate measures were employed. The first measure, designed to assess analogical reasoning, was the Employee Aptitude Test (EAS) measure (Merrifield, Guilford, Christensen, & Frick, 1962). This 30-item test asks participants to complete a set of logic problems in a timed setting. This test has provided a reliability coefficient in the mid .60s (Guilford & Hoepfner, 1966). Construct validity evidence can be found in (Grimsley & Jarrett, 1973). The other covariate measure administered to assess participant's cognitive ability was Christensen, Merrifield, & Guilford's (1958) consequence measure. Designed to measure one's divergent thinking ability, participants are asked a question and then asked to respond by listing as many consequences as they can in a timed setting. Reliabilities produced by this

test are in the high .80s. Criterion and construct related validity evidence for this measure may be obtained in Vincent, Decker, & Mumford (2002).

To assess personality influences on planning, two additional scales were used. First, the goal orientation scale was administered to evaluate participants' task-specific goal orientation (Brett & VandenWalle, 1999). This thirteen-item measure uses a five-point scale to assess three dimensions of goal orientation including learning orientation, performance prove, and performance avoid. Reliabilities ranging from .57 to .79 with average reliability of .68 were established for this measure. Evidence for the validity of this measure can be obtained from Elliot & Church (1997). Second, the need for cognition scale was administered to measure participants' need for cognitively challenging situations (Cacioppo, Petty, & Kao, 1984). This 18 item measure also uses a five-point scale to obtain one's overall need for cognition. A reliability coefficient of .85 was obtained for this measure. Evidence for the validity of this measure can be obtained from Cacioppo & Petty (1982).

Finally, to assess experience related influences, an educational history scale was administered. To complete this measure, participants rate five questions on a five-point scale concerning their experience in education and education related fields. A reliability coefficient of .76 was obtained. Evidence for the validity of this measure can be obtained from Scott, Lonergan, and Mumford (in press).

Training

Upon completion of the covariate measures, participants were asked to complete a set of instructional materials. Participants received one of six different sets of instructional materials depending on the condition to which they were randomly assigned.

The training materials trained participants on one of two planning skills using one of three training methods. Training materials taught the planning skill of forecasting downstream consequences or the planning skill of identifying key causes. Training materials used a principle-based, case-based, or principle- and case-based method of instruction.

Regardless of condition, to train planning skills, a self-directed, self-paced, programmed instruction method was employed. To facilitate this training, an instructional packet was designed that consisted of a workbook and answer booklet. Participants were asked to read their instructional workbook and complete the corresponding answer booklet at their own pace. The workbook was divided into seven small units to facilitate learning (Goldstein & Ford, 2001). Each unit focused on one of seven heuristics of the planning skill being taught. Recall that a heuristic is mental aid that simplifies complex concepts (Hogarth, 1987). Here, a heuristic is used as a way to cognitively chunk the planning skill into more manageable and learnable components.

Each unit contained five basic components to facilitate learning. These components included a knowledge component, a multiple-choice test, a self-evaluation, an example of the skill applied to a real-world setting, and a practice exercise. The knowledge component consisted of a one-page explanation of the heuristic. The explanation included a definition of the heuristic, a short two-paragraph description of the effects of the heuristic and why it is important to planning, and a four-step process of how to execute the heuristic. An example of an explanation sheet can be seen in Appendix A.

After reading the explanation page, the participant was asked to answer four multiple-choice questions over the material he or she had just read. These questions served as a knowledge reconfiguration task for the participant. After answering these questions, the participant was asked to evaluate his or her own answers, by using an answer key that was provided in the instructional booklet. This process gave the participants immediate feedback on their learning performance. Feedback was used to reinforce correct answers and adjust incorrect ones. Examples of the multiple-choice questions and corresponding answer key can be seen in Appendix B.

Next, participants were asked to read an example of the heuristic applied in a realistic setting. In this example, the application of the heuristic is illustrated using a real-world scenario. However, these illustrations differed in structure according to conditions. Participants were presented with an illustration that used a principle-based format, a case-based format or both formats.

Finally, the participant was asked to practice applying the heuristic to a given scenario. In this exercise, participants were asked to read a three to four paragraph scenario. The scenario consisted of a brief history of the situation, a description of the current status, and an explanation of the issue at hand. Based on this scenario, participants were given an open-ended question asking them to apply the heuristic to the situation. This exercise allowed the participant to practice performing each heuristic.

Manipulations

Causes vs. Forecasting. The first variable manipulated within these training exercises involved the content of the material. One group received training on the planning skill of forecasting downstream consequences while the other group received

training on the planning skill of identifying key causes. To better train these skills, the two planning skills were each broken down into seven heuristics.

In training the planning skill of identifying key causes, seven heuristics were used. These heuristics included: 1) identification of basic causes (Van der Linden et. al., 2001), 2) identification of important factors (Pattan, 1986), 3) identification of causes that have multiple outcomes (Isenberg, 1986), 4) identification of causal factors that can be manipulated (Dutton & Duncan, 1987), 5) identification of indirect outcomes of key causes (Dutton, Fahey, & Narayanan, 1983), 6) identification of dependent causes (Haberlandt & Bingham, 1984), and 7) rating causes by importance (Doerner & Wearing, 1995). Definitions and further explanations of these heuristics can be found in Table 1.

To train the planning skill of forecasting, training materials included seven heuristics. These heuristics included: 1) identification of positive consequences (Lonergan, et.al., in press), 2) identification of negative consequences (Lonergan, et al., in press), 3) identification of short-term outcomes (Garling, 1994), 4) identification of attainable long-term goals (Hayes-Roth & Hayes-Roth, 1979), 5) identification of contingencies and restrictions (Patalano & Seifert, 1997; Garling, 1994), 6) identification of where errors are likely (Hogarth, 1987), and 7) identification of areas that require back-up plans (Zajac & Bazerman, 1991). Definitions and further explanations of these heuristics can be found in Table 2.

Case vs. Principle Based. In addition, the training materials differed in training structure. After instructional material was presented that explained how to identify causes or forecast, skill was demonstrated in a contextual illustration. The training structure differed in how this illustration of the heuristic was presented. Structures

included a case-based approach, a principle-based approach, and a combination of the case-based and principle-based approaches.

Although the structure of the illustrations differed, the material used for the illustration remained constant. Information drawn from case studies was used to further describe the heuristics. These case studies were acquired one of two ways. Cases were either acquired from a review of previously published cases or were created by the experimenter. First, case studies were extracted from literature (David, 2003). Specifically, the experimenter reviewed 42 business related case studies. Case studies that clearly illustrated one of the heuristics were selected and edited to a one or one and-a-half page summary. In addition, the experimenter modified some case studies to better illustrate the specific heuristic. Second, the experimenter created case studies to illustrate some heuristics. These case studies were written to be similar in content, format, and length to the published case studies. Case studies that were taken from the literature were based on actual companies. However, the experimenter changed all company names so that all cases would appear hypothetical.

Cases were chosen or written according to several guidelines. First, the scenario had to be business or organizationally related. Second, the scenario must have dealt with managerial issues. Third, the length of the scenario must be no less than one page and no more than one and a half pages in length. These considerations ensured that participants received equivalent training across conditions.

Each heuristic was illustrated by applying that heuristic in a realistic setting. Still, that information was organized into one of two conditions. In one condition, the example was given in a case study format. In the case study format, the case was presented in a

typical case study or story-like format. The heuristic was embedded in this story along with various other extraneous pieces of information. At the end of the case study, the principles of the heuristic were briefly summarized into one or two sentences. An example of this format can be seen in Appendix D. In the second condition, the scenario was broken into a principle-based format. Using this format, the same scenario material was shortened and clustered according to the basic steps or principles required in conducting that heuristic. Each step or principle would be listed and then the case material that illustrated that principle would be listed. An example of this format can be seen in Appendix E. In the final condition, the group received both structures of the training material, including the case-based and the principle-based illustrations of each heuristic.

Experimental Planning Task

After the completion of the training materials, participants completed an experimental task to assess their overall planning abilities. The experimental task was a preexisting item that contains a scenario followed by an essay-type task (Scott, et al., in press). First, participants read a two-page scenario that required them to assume the role of principal of a public secondary school. The scenario described an experimental high school involved in a national study aimed at increasing achievement in schools throughout the United States. The goal of each experimental school was to plan a new type of educational program that increases students' academic performance. At the end of the school year, each school will be evaluated on the amount of academic improvement of the students in the schools.

This scenario was developed based on four considerations. First, the scenario provided a complex, ill-defined problem in the sense that the problem solution could be achieved in a number of different ways. Second, the scenario provided a socio-technical problem domain by requiring participants to organize and structure interpersonal activities in a high school classroom in order to meet the common goal of better educating students. Third, the materials provided to describe the current instructional models were detailed in depth by experts in the educational literature. Finally, because the participants in the study were recent graduates of high schools themselves, they were expected to have adequate familiarity with the stimulus materials and be able to generate workable solutions to the problem.

Participants were asked to plan a new teaching method as well as other strategies for the experimental school that would increase the academic test scores and overall education levels of its students. Participants were given two different models of classroom instruction to foster ideas and help them get started. Participants were then given an open-essay question asking them to write their plan on a blank page provided. They were reminded to include teaching strategies, process improvement ideas, special programs, etc. They were also reminded that they should produce a plan where all these components and ideas work together.

Ratings of the plans generated for the experimental planning task served as the major dependent measure. Plans were rated on four dimensions. Rating dimensions included: practicality, originality, quality, and elegance. Ratings were given using a one to five Likert scale with one being the lowest rating and five being the highest rating.

To collect these ratings, several steps were taken. First, the experimenter defined each scale and listed considerations that should be taken when identifying high, medium and low examples of each scale. Definitions of the five scales can be found in Appendix I. Next, the experimenter collected sample responses that demonstrate high, medium, and low performance based on a standard deviation of performance for the entire sample. Then, raters were trained to rate the responses based on the definition of the construct and comparison to the benchmarks. Five raters independently evaluated the plans on the five given dimensions. Interrater reliability coefficients were obtained using procedures suggested by Shrout and Fleiss (1979). Inter-rater reliability ranged from .54 to .79 with an average of .69. Evidence of the validity of this measure can be found in Scott, et al. (in press).

Pre and Post Planning Measure

A pre and post planning measure was administered to participants to assess their level of planning skills both before and after they received training. The planning skills measure is a preexisting measure that contains a series of business scenarios followed by a set of multiple-choice questions (Marta, et.al., in press). For the pre-test participants answered multiple-choice questions concerning six scenarios for a total of 31 questions. For the post-test participants answered a total of 35 multiple-choice questions concerning seven scenarios.

The items for this measure were designed using a low fidelity simulation approach proposed by Motowidlo, Dunnette, and Carter (1990) and an assessment of complex cognitive skills proposed by Mumford, Baughman, Supinski, and Anderson (1998). To develop this measure, the researchers identified managerial cases that involve

the formation of a plan to deal with a particular problem. Based on the case material, two psychologists developed questions directed toward a critical aspect of the case. These questions were designed to assess five planning relevant skills. These skills include: identification of key causes, identification of restrictions, identification of downstream consequences, use of opportunistic implementation strategies, and effective environmental scanning. For each question, the psychologists developed 8 to 12 potential response options that represented the application of the planning skill under consideration. Participants were told to select two to four response options for each question.

Three judges rated these response options based on good, poor, or neutral responses. An interrater agreement of .82 was obtained for these ratings. The number of good responses, chosen by participants, was used to measure participant's planning skills on the five scales identified. The average of correct answers on these five scales provided the overall measure of planning skills for each participant. The scores' overall reliability was in the low .80s as estimated using a split-half coefficient. Evidence for this measure's construct validity can be obtained in Marta, et. al. (in press).

Practice Exercises

Ratings of answers to the open-ended practice exercises were used as a control variable for learning. A practice exercise was given to participants for each heuristic. Consequently, each participant completed seven practice exercises. The practice exercise was given after the participant read the information sheet, answered the four knowledge questions, and read the illustration of the heuristic.

The practice exercise followed the same format for each heuristic. Participants were given a brief scenario broken into three parts including a brief history of the situation, the status or problem of the situation, and the initial plan to deal with the given situation. Then, participants were given an open-ended question asking them to practice utilizing this heuristic for the given situation. For instance, participants were told about a plan that a metro hospital made to turn their bleak situation around. Then, participants were asked to identify the positive consequences that they could foresee to come from this situation.

Ratings of these answers were used as a dependent measure labeled learning. An overall quality rating was given to the seven answers. Answers were rated on a one to five Likert scale. The ratings were assigned to an answer based on the number of correct answers and the originality of the answers. Ratings were assigned by the experimenter.

Analyses

A Multiple analysis of covariance (MANCOVAs) was used to evaluate the effects of the manipulations on the practicality, quality, originality, and elegance scores that resulted from the judges' ratings of the planning task. Due to the distinctive nature of the other dependent variable, separate Analyses of covariance (ANCOVAs) were used to evaluate the effects of the manipulations on the results of the practice exercises (referred to from here as learning) and the planning skills post-test (referred to from here as planning skills). Covariates described earlier were incorporated into analyses; however, only covariates that yielded a significant F value ($p < .10$) were included in the final analyses. Non-significant covariates were eliminated due to the substantial loss of power.

In addition, the pre-test calculating planning skills was only used as a covariate when assessing the planning skills post-test dependent variable.

Additional analyses were conducted to evaluate how the effects found in the initial set of analyses were modified by individual differences. To assess how individual differences interacted with the manipulations, separate grouping variables for individual differences were obtained based on information derived from the covariate measures. For each covariate scale, participants were divided into two categories, a high and low group, based on a median split of the scores. A total of eight individual differences were examined including: educational history, divergent thinking fluency, divergent thinking flexibility, verbal intelligence, need for cognition, learning orientation, performance prove, and performance avoid. Separate analyses were run for each median split group for each dependent variable. MANCOVAs were used to evaluate the effects of the manipulations on the practicality, quality, originality, and elegance scores for each median split group. ANCOVAs were used to evaluate the effects of the manipulations on the scores of learning derived from the practice exercises as well as planning skills for each median split group.

Results

Overall Effects

Table 3 presents the results from the overall analyses of covariance and multivariate analyses of covariance of the three outcome variables of learning during training, the acquisition of planning skills, and planning performance (including practicality, originality, quality, and elegance performance scales) and differences in training content (causal training or forecasting training) and training structure (case-based

training, principle-based training, or case-based and principle-based training). With regard to learning, a main effect was found for training structure $F(1, 168) = 5.01$, $p \leq .01$ with significant covariates of self-learning perceptions $F(1, 168) = 14.35$, $p \leq .01$ and verbal intelligence $F(1, 168) = 3.84$, $p \leq .05$. Overall, participants given principle-based training seemed to learn better ($M = 3.23$, $SE = .09$) compared to those that were given either case-based training ($M = 2.85$, $SE = .09$) or a combination of case and principle-based training ($M = 2.86$, $M = .09$). With regard to planning performance, a main effect of training content was obtained $F(4,159) = 2.19$, $p \leq .10$ when fluency of divergent thinking was taken into account $F(4, 159) = 3.56$, $p \leq .01$. Further univariate analyses of the four performance scales indicated that these results derived from the practicality of the plans produces $F(1,168) = 6.15$, $p \leq .05$ with causal training ($M = 3.42$, $SE = .07$) outperforming forecasting training ($M = 3.17$, $SE = .07$).

There seems to be a general trend that, with regard to learning, principle-based training is best. As for planning performance, the identification of causes training seems to produce better plans than forecasting training. However, upon further examination of these trends with regard to individual differences, these findings do not entirely hold true. There seem to be dramatic changes in performance based on type of outcome being considered and the type of individual performing.

Learning

Table 4 presents the main effects when considering learning as an outcome for both the overall sample as well as with each of the individual difference variables. Significant main effects were found for instructional method consistently across the analyses of covariance that were run using individual differences as grouping variables.

Main effects found for seven of the eight covariates were 1) Verbal Intelligence, F (2, 168) = 5.49, $p \leq .01$ (Case-based: M = 2.84, SE = .10 vs. Principle-based: M = 3.23, SE = .09 vs. Case and Principle-based M = 2.89, SE = .10); 2) Fluency of Divergent Thinking, F (2, 168) = 3.26, $p \leq .05$, (Case-based: M = 2.85, SE =.09 vs. Principle-based: M = 3.15, SE = .09 vs. Case and Principle-based: M = 2.86, SE = .09); 3) Educational History, F (1, 168) = 4.28 $p \leq .05$, (Case-based: M = 2.85, SE = .10 vs. Principle-based: M = 3.19, SE = .09 vs. Case and Principle-based: M = 2.87, SE = .10); 4) Need for Cognition, F (2, 168) = 4.15 $p \leq .05$, (Case-based: M = 1.37, SE = .07 vs. Principle-based: M 1.64, SE = .06 vs. Case and Principle-based: M = 1.52, SE = .07); 5) Learning Orientation, F (2, 168) = 6.71 $p \leq .01$, (Case-based: M = 2.83 SE = .10 vs. Principle-based: M 3.26, SE = .09 vs. Case and Principle-based: M = 2.86, SE = .10); 6) Performance Prove, F (2, 168) 3.94 $p \leq .05$, (Case-based: M = 2.89, SE = .09 vs. Principle-based: M = 3.19, SE = .09 vs. Case and Principle-based: M = 2.86, SE = .10); 7) Performance Avoid, F (2, 168) = 2.68 $p \leq .10$, (Case-based: M = 2.86, SE = 0.09 vs. Principle-based: M = 3.20, SE = .09 vs. Case and Principle-based: M = 2.85, SE = .09). As stated previously, a general trend seems to emerge in that principle-based structured training is best in regards to learning. However, this main effect of structure on the outcome of learning was moderated by the content of training in combination with individual differences.

Individual Differences in Ability for Learning

Upon examining the individual difference of verbal intelligence on learning, it was found that when participants were trained in the application of causes, principle-based instruction (M =3.54, SE = .19) led to better learning for more intelligent

participants as compared to all other conditions (M = 2.85, SE =.19). This effect did not, however, hold true when participants were trained in forecasting. Here, high ability participants outperformed low ability participants across all forms of instruction (M = 3.24, SE = .19 vs. M = 2.77 SE = .18 respectively). This may be due to the similarities intelligent people find between causes and principles. Table 5 presents the results from the analyses of covariance for verbal intelligence. Interactions can be found in Appendix F.

Differences were also detected between individuals of differing creative abilities. When considering flexibility, principle-based instruction for participants of high ability seemed to work best compared to all other conditions, given that causes were being trained (M = 3.41, SE = .15 vs. M = 2.82, SE = .21) However, if forecasting was being trained, there were no particular advantages to the training structure in regards to learning. Rather, participants higher in flexibility outperformed those lower in flexibility across all conditions (M = 3.10, SE = .21 vs. M = 2.99, SE = .18). Table 6 presents the results from the analyses of covariance for flexibility. Interactions can be found in Appendix F.

For fluency, particularly high performance occurred when participants with high ability were trained to identify causes using principles compared to the other two methods (M = 3.29, SE = .16 vs. M = 2.86, SE = .19). Moreover, case-based training for causes was particularly ineffective for those high in fluency (M = 2.69, SE = .20). This relationship, however, did not hold for forecasting. For forecasting, the instructional method established only one notable effect with principle-based instruction proving useful for those low in fluency (M = 3.33, SE = .16). With fluency, participants who

received principle-based training learned better than those that received case-based training (Principle: M = 3.15, SE = .18 vs. Case: M = 2.85, SE = .19). For those of high ability, whether it will be creativity or intelligence, it seems that principle-based instruction is best when learning to identify causes. In terms of an individual's ability and learning forecasting, it appears there is no real difference between instructional methods. For fluency, Table 7 presents the results from the analyses of covariance. Interactions can be found in Appendix F.

Individual Differences in Motivation for Learning

With regard to motivation, some shifts were observed in this general pattern of findings. For example, when training causes, case-based training led to particularly poor performance for those who have a low need for cognition (M = 1.39, SE = .12) with respect to all other conditions (M = 1.57, SE = .14). On the other hand, when training forecasting, case-based training led to particularly poor performance for people high in need for cognition (M = 1.18, SE = .13) compared to all other conditions (M = 1.54, SE = .13). For need for cognition, Table 8 presents the results from the analyses of covariance. Interactions can be found in Appendix F.

With regard to motivation, when performance avoidance was examined, it was found that combining case and principle instruction for causes was particularly detrimental to performance vis-à-vis all other conditions regardless of motivation to avoid performance (M = 2.73, SE = .19 vs. M = 3.05, SE = .18, respectively). Apparently, presenting too much material is demotivating or threatening to people. Conversely, combining case and principle instruction for forecasting was particularly beneficial for those high in performance avoidance compared to the other training

methods (M = 3.33, SE = .18 vs. M = 2.94, SE = .18). The results from the analyses of covariance run with performance avoidance as the grouping variable can be seen in Table 9. Interactions can be found in Appendix F.

Performance

When examining planning performance, a general trend was found for the content variable (e.g. training identification of causes or forecasting) with respect to practicality across most relevant individual differences. Significant main effects found for both the overall sample as well as with each individual difference analyses of covariance are listed in Table 10. These main effects were 1) Verbal Intelligence with Practicality, $F(1,168) = 6.63$, $p \leq .05$, (Causes: M = 3.42, SE = .07 vs. Forecasting: M = 3.15, SE = .07); 2) Fluency of Divergent Thinking with Practicality, $F(1, 168) = 6.09$, $p \leq .02$, (Causes: M = 3.41, SE = .07 vs. Forecasting: M = 3.16, SE = .07); 3) Educational History with Practicality, $F(1,168) = 6.57$, $p \leq .05$, (Causes: M = 3.42, SE = .07 vs. Forecasting: M = 3.15, SE = .07); 4) Need for Cognition with Practicality, $F(1,168) = 6.92$, $p \leq .01$, (Causes: M = 3.42, SE = .07 vs. Forecasting: M = 3.16, SE = .07); 5) Learning Orientation with Practicality, $F(1,168) = 7.53$, $p \leq .01$, (Causes: M = 3.44, SE = .07 vs. Forecasting: M = 3.16, SE = .07); 6) Performance Prove with Practicality, $F(1,168) = 8.43$, $p \leq .01$, (Causes: M = 3.45, SE = .07 vs. Forecasting: M = 3.15, SE = .07); 7) Performance Avoid with Practicality, $F(1,168) = 6.62$, $p \leq .05$ (Causes: M = 3.42, SE = .07 vs. Forecasting: M = 3.15, SE = .07). Taken as a whole, it appears that training participants to identify causes works better than training participants to forecast in plan construction. However, this main effect of content on performance also appeared to be moderated by a series of person by treatment interactions.

Individual Difference in Ability for Performance

When considering the individual differences in flexibility of divergent thinking, a content by structure interaction was detected for the practicality scale. When learning causes, the interaction indicated that principle-based training or a combination of case and principle-based training seemed to work better than simple case-based training (M = 3.51, SE = .13 vs. M = 3.19, SE = .13), a finding suggesting that creative people need principles to work with causes. In terms of forecasting, the interaction indicated that case-based training and principle-based training led to enhanced performance compared to a combination of case and principle-based training (M = 3.30, SE = .13 vs. M = 2.89 SE = .13), a finding that suggests that creative people should not be overloaded when forecasting.

For the originality scale, a three-way interaction between training content, structure, and flexibility in divergent thinking was obtained. For those high in flexibility, training on causes seemed to work best when presented with a combination of case and principle-based training (M = 3.11, SE = .22) rather than the case-based or principle-based training alone (M = 2.83, SE = .21). Apparently, training can set undue constraints on creative people unless they see how material can be applied in context. For those low in flexibility, training in identification of causes combined with principle-based training seemed particularly helpful for creating original solutions (M = 3.56, SE = .28 vs. M = 2.97, SE = .22), perhaps by providing a basis for rule-based generalities. Results from the multivariate analyses of covariance for flexibility are presented in Table 6. Analyses of covariance results done with the significant scales are presented in Table 11. Interactions can be found in Appendix G.

In examining performance of those who are high or low in fluency, a similar pattern of findings emerged. When examining the practicality criteria, a two-way interaction between content and structure was obtained. This interaction indicated that people produced more practical original solutions when given training on causes than when given training on forecasting (M = 3.41, SE = .13 vs. M = 3.04, SE = .16). Apparently, better analysis of causes allows people to produce more useful plans. This interaction also indicated that when training causes, those who receive either principle-based training or a combination of case and principle-based training outperform those who receive case-based training alone (M = 3.52, SE = .13 vs. M = 3.20, SE = .13), indicating that the availability of principles may be critical.

When considering the effects of the variables on the originality of the solutions, a three-way interaction between content, structure, and fluency emerged. When training creative people to identify causes, using a combination of case and principle-based training seemed to work better than case-based or principle-based training per se (M = 3.53, SE = 2.52 vs. M = 3.02, SE = .21). However, when training creative people to forecast, using a combination of case and principle-based training seemed to be detrimental to the generation of original solutions (M = 2.89, SE = .21 vs. M = 3.26, SE = .23). In regards to training low fluent creative people, principle-based training seems to work particularly well when training how to identify causes (M = 3.41, SE = .24 vs. M = 2.70, SE = .22). When training low fluent creative people how to forecast, a combination of case and principle-based training seems to work best (M = 2.91, SE = .22 vs. M = 2.67, SE = .19). It seems low fluent creative people desire parameters in which to work. Results from the multivariate analyses of covariance for fluency are presented in Table 7.

Analyses of covariance results done with the significant scales are presented in Table 11. Interactions can be found in Appendix G.

Individual Differences in Motivation for Performance

In examining performance with regard to the motivational variables need for cognition, performance prove, and performance avoid produced significant interactions. When considering the need for cognition, those motivated by the need for cognition do better trained in causes using case-based and principle-based training verses a combination of case and principle-based training in terms of originality of obtained solutions (M = 3.40, SE = .23 vs. M = 2.69, SE = .24). Apparently, the analytic orientation of those high in need for cognition is disrupted when mixed material is presented.

Likewise, those motivated by the need for cognition produced higher quality plans when trained in causes using either case-based or principle-based training but not when given a combination of case and principle-based training (M = 3.26, SE = .22 vs. M = 2.82, SE = .22). In the same way, those highly motivated by the need for cognition created more elegant plans when trained in causes using either case-based or principle-based training but not when given a combination of case and principle-based training (M = 3.32, SE = .24 vs. M = 2.90, SE = .24). Again, combinations of instructional methods may disrupt logical analysis.

When training forecasting, those motivated by the need for cognition do not seem to be affected by instructional method for any of the performance scales: 1) Originality (Case and Principle-based: M = 3.11, SE = .19 vs. Case-based: M = 2.84, SE = .21, vs. Principle-based M = 3.04, SE = .20) 2) Quality (Case and Principle-based: M = 2.90, SE

= .18 vs. Case-based: M = 2.90, SE = .20, vs. Principle-based M = 2.95, SE = .19) and 3) Elegance (Case and Principle-based: M = 2.83, SE = .19 vs. Case-based: M = 2.77, SE = .21, vs. Principle-based M = 3.04, SE = .20). However, for those low in need for cognition, a combination of case and principle-based training proved to inhibit the production of original solutions (M = 2.54, SE = .24 vs. M = 2.96, SE = .21), quality solutions (M = 2.48, SE = .22 vs. M = 2.85, SE = .20), and elegant solutions (M = 2.48, SE = .24 vs. M = 2.96, SE = .21). This trend is likely an outcome of the unwillingness of people low in need for cognition to work with complex sets of material in training. Results from the multivariate analyses of covariance for need for cognition are presented in Table 8. Analyses of covariance results done with the significant scales are presented in Table 11. Interactions can be found in Appendix E.

When considering the performance proof variable, a two-way interaction occurred between the content of the training and the need of proof of performance. Those highly motivated to prove their performance did better when trained in causes with respect to solution originality (M = 3.24, SE = .13 vs. M = 2.87, SE = .12), solution quality solutions (M = 3.20, SE = .12 vs. M = 2.78, SE = .11), and solution elegance (M = 3.33, SE = .12 vs. M = 2.82, SE = .12). However, those high in motivation to prove performance capability did not perform as well as those with a low need for performance proof when forecasting with regard to solution originality (M = 2.97, SE = .12 vs. M = 2.81, SE = .13), solution quality (M = 2.87, SE = .11 vs. M = 2.60, SE = .12), and solution elegance (M = 2.87, SE = .12 vs. M = 2.63, SE = 2.63, SE = .13). This shift may reflect the tendency of performance oriented people to focus on practical actions rather than implications. Results from the multivariate analyses of covariance for performance

prove are presented in Table 12. Analyses of covariance results done with the significant scales are presented in Table 11. Interactions can be found in Appendix H.

When considering those who have a high or low need to avoid performance failure, a three-way interaction occurred between the content of the training, the structure of the training and the need to avoid failure in performance. When training cause identification, those high in the need to avoid performance failure produced slightly better quality plans with principle-based training or a combination of case and principle-based training versus case-based training alone (M = 3.14, SE = .22 vs. M = 2.89, SE = .18). Similarly, when those high in the need to avoid performance failure receive training in causes, principle-based training led to more elegant solutions than other types of training (M = 3.34, SE = .21 vs. M = 2.85 = .20). Moreover, case-based training of causes also seemed to be particularly detrimental to the quality of obtained plans (M = 2.54, SE = .21 for high vs. M = 2.88, SE = .20 for high) and the elegance of obtained plans for those high in the need to avoid performance failure (M = 2.59, SE = .23 for high vs. M = 3.05, SE = .21 for low). Taken as a whole, case-based training perhaps due to its ambiguity, proved particularly ineffective in enhancing causal analysis for those concerned with getting the right answer.

When given forecasting training, however, those high in the need to avoid performance failure create better quality plans with case-based training or a combination of case and principle-based structured training as opposed to principle-based training alone (M = 2.98, SE = .19 vs. M = 2.50, SE = .20). Likewise, when given forecasting training, those high in the need to avoid performance failure produced more elegant plans when given case-based training or a combination of case and principle-based structured

training verses principle-based training alone (M = 3.00, SE = .21 vs. M = 2.41, SE = .21). This case-based instruction proved more useful in training forecasting skills than causal analysis skills for those selecting to avoid failure perhaps because cases explicitly incorporate errors to be avoided in future efforts (Hammond, 1990). Results from the multivariate analyses of covariance for performance avoidance are presented in Table 9. Analyses of covariance results done with the significant scales are presented in Table 11. Interactions can be found in Appendix G.

Planning Skills

When examining the acquisition of planning skills as an outcome, very little was found in the way of main effects or interactions. One noteworthy finding was a two-way interaction that was found between structure and learning orientation. However, given the scarcity of significant effects, this finding might simply be attributed to Type 1 error.

Discussion

Planning is a critical component of good leadership. Planning contributes to group performance and overall organizational success. Yet, the literature does not address how planning skills should be trained and developed within individuals. This study examined whether planning performance can be improved through training.

Limitations

Before discussing the conclusions drawn from this research, certain limitations should be addressed. To begin with, the present research used a student sample. As a result, the generalizability of the findings of this study to other populations may be limited (Hartman & Lundberg, 1993). By the same token, however, several features of the study do argue for the generalizability of the findings obtained. Most centrally

students were asked to work on a "real-world" simulation in a domain where they had the expertise needed to produce viable plans.

Another limitation that should be noted is that the effects reported in this study may be overly conservative. Conservative estimates could be due to the tight controls placed on the conditions of this study. If the conditions differed with greater intensity, it is likely the effects that were found would be even greater than the ones reported in this study.

In addition, training for this study was self-paced. Although the training still affected learning and performance, the effects of more intense, demanding training is still unknown. Moreover, it is possible that the use of other instructional methods, for example classroom instruction, might have produced somewhat different results.

Finally, this study only speaks specifically to two aspects of planning; identification of key causes and forecasting downstream consequences. Prior work by Mumford, Shultz, and Osburn (2000), indicate that multiple processes are involved in planning including environmental scanning and backup plan generation. These processes are not considered in the present study. Nevertheless, causal analysis and forecasting are commonly considered two of the more critical determinants of planning performance (Doerner & Schaub, 1994; Thomas & McDaniel, 1990).

Findings

Overall, it seems that the importance of the characteristics of training both content (i.e. identification of key causes and forecasting) and instructional method (i.e. case-based training, principle-based training, or a combination of case and principle-based training) differ according to the outcomes being considered. For the outcome of learning,

the instructional method had a significant impact. For learning, there was a general trend that principle-based training is better than case-based training or a combination of case and principle-based training. For the outcome of planning performance, the content of training made a difference. The identification of causes training produced better plans than forecasting training.

However, these findings were further examined to find out how they might differ according to individual differences. Individual differences that were examined were ability differences that included verbal intelligence, a creativity measure of fluency of divergent thinking, a creativity measure of flexibility of divergent thinking, and individual motivational variables that included the need for cognition, learning orientation, the need to prove one's performance, and the need to avoid failure in performance. Upon further examination of these trends, it was discovered that the original findings did not entirely hold true with regard to individual differences. Further analyses discovered dramatic changes in performance based on type of outcome being considered and the type of individual performing. For example, as stated previously, a general trend seemed to emerge in that principle-based training was best for the outcome of learning. However, this main effect of method on learning was moderated by the content of training in combination with individual differences. Therefore, it was important to interpret these findings in terms of the relationships between the desired outcome of training, the content of training, the training method, and the individual being trained.

In regards to the outcome of learning, a general trend was found that when training those of high ability to identify causes, whether it is high in intelligence or

fluency of divergent thinking or flexibility of divergent thinking, principle-based structured training works best. In terms of an individual's ability and learning forecasting, it appears there is no real difference between instructional methods. However, principle-based training seems to help those with low in flexibility.

With regard to the outcome of planning performance, it appears training participants to identify causes improves performance better than training participants to forecast. This is most likely due to the fact that training forecasting alone, does not help performance unless that individual is focused on the right variables. Still, while it is generally true that causal content works better than forecasting content, the effects of content on planning performance seem to be moderated by both structure of the training and individual differences.

Although no significant relationships were obtained for intelligence and performance, there were several significant relationships found between creativity and planning performance. When creative people are trained to identify causes, they create more practical plans when given training that uses principles, either in part or in whole. In addition when creative people are trained to identify causes, they create more original plans when given a combination of case and principle-based instruction. Moreover, principle-based instruction helps those low in creative ability create more original solutions. These findings suggest that creative people need principles to work with causes (Baughman & Mumford, 1995). However, when creative people were given training in forecasting, a combination of case and principle-based instruction hurt their performance. This finding suggests that creative people need a clear framework that allows effective extrapolation of the material trained. However, a combination of case

and principle-based instruction was found helpful when low ability people were trained in forecasting perhaps because concrete examples are easier for people to work with (Kubose, Holyoak, & Hummel, 2002).

When we examined the relationships between performance and motivation, several findings emerged. When people high in need for cognition are trained in causal analysis, they construct better plans in quality, originality, and elegance when given case-based training or principle-based training as opposed to a combination of case and principle-based training. It appears that the combination of instructional methods disrupts logical analysis. This does not hold true for forecasting. No preference was found for those motivated by the need for cognition for an instructional method. Still, for those low in need for cognition, it was found that a combination of case and principle-based training was detrimental to performance. This was thought to reflect the unwillingness of people low in need for cognition to work with complex sets of material (Adams & Ericsson, 2001; Guilford & Hoepfner, 1966).

In addition, it was found that those motivated to prove their performance did better given training in causal analysis than when given training in forecasting. However, for those low in motivation to prove their performance the opposite was true. Those low in motivation to prove their performance did better given training in forecasting over causes. Perhaps due to its ambiguity, case-based training proved particularly ineffective overall in enhancing causal analysis for those concerned with proving themselves.

Finally, it was found that those motivated to avoid failure in their performance, when given training in causal analysis, seemed to perform better with principle-based or a combination of case and principle-based training. However, those motivated to avoid

failure performed best when given training in forecasting that was case-based or a combination of case and principle-based training. This case-based instruction proved more useful in training forecasting skills than causal analysis skills for those selecting to avoid failure perhaps because cases explicitly incorporate errors to be avoided in future efforts (Hammond, 1990).

Implications

Several important implications can be drawn from on this study. First, the current research suggests that planning skills can be trained. Planning is often considered a skill that must be learned through experience or trial and error (Mintzberg, 1991). Therefore, the skill of planning is often not taught within organizations (Miller & Cardinal, 1994). Even so, both training of causal analysis and training of forecasting had differential positive impacts on learning and planning performance. It is also noteworthy that positive effects were found despite the self-paced nature of the training as well as the fact that only one planning skill was taught during training. It seems plausible that the impact of training on planning performance would be even greater if the training were more intense and if additional planning processes were taught.

If we have determined that we can indeed train planning processes, then the next questions become what do we train and what is the best method of instruction? It seems, as a general rule, the training of causal analysis works better than forecasting in terms of planning performance. It also seems that principle-based instruction contributes to learning over case-based instruction or a combination of case and principle-based instruction. In addition, a broad statement might be made that principle-based instruction works best for training causal analysis where as case-based instruction works better for

training forecasting. However, future trainers should be warned that these general rules come with severe caveats. Mainly that the effects of training content and instructional method changes according to the outcome being considered and the type of individual performing. Due to this, it seems imperative that training be tailored toward the audience and the desired outcome of the training.

Also based on this study, two key molecular procedures of planning including the identification of key causes and forecasting can be further examined and compared based on the current research. It seems evident that both can benefit planning. It also appears that the two skills may be more appropriate in different environments. For instance, environments that are clearly defined may work better with causal analysis. Also, it seems that forecasting may be more appropriate when working in ill-defined domains . However, what is surprising is that causal analysis seems to benefit planning over that of forecasting. This is contradictory to the current literature, which emphasizes forecasting as the more critical component of planning (Doerner & Schaub, 1994; Noice, 1991). If this is true, perhaps a shift in theory is needed.

One other more practical implication that can be taken from this study is this study helped to further validate the complex problem-solving criterion task. This task can be used to simulate and assess a complex and dynamic environment without introducing information that the student does not understand and cannot grasp. This study helps us to be able to focus on the student's problem solving abilities without having to focus on their lack of knowledge in this domain. This test, first used in Scott, Lonergan and Mumford (in press), has been used in several other studies to measure elements of creativity, planning and leadership. Further validating this measure would

allow this exercise to be used to simulate and measure complex problem solving in future studies.

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Figure 1: Model of Planning Process

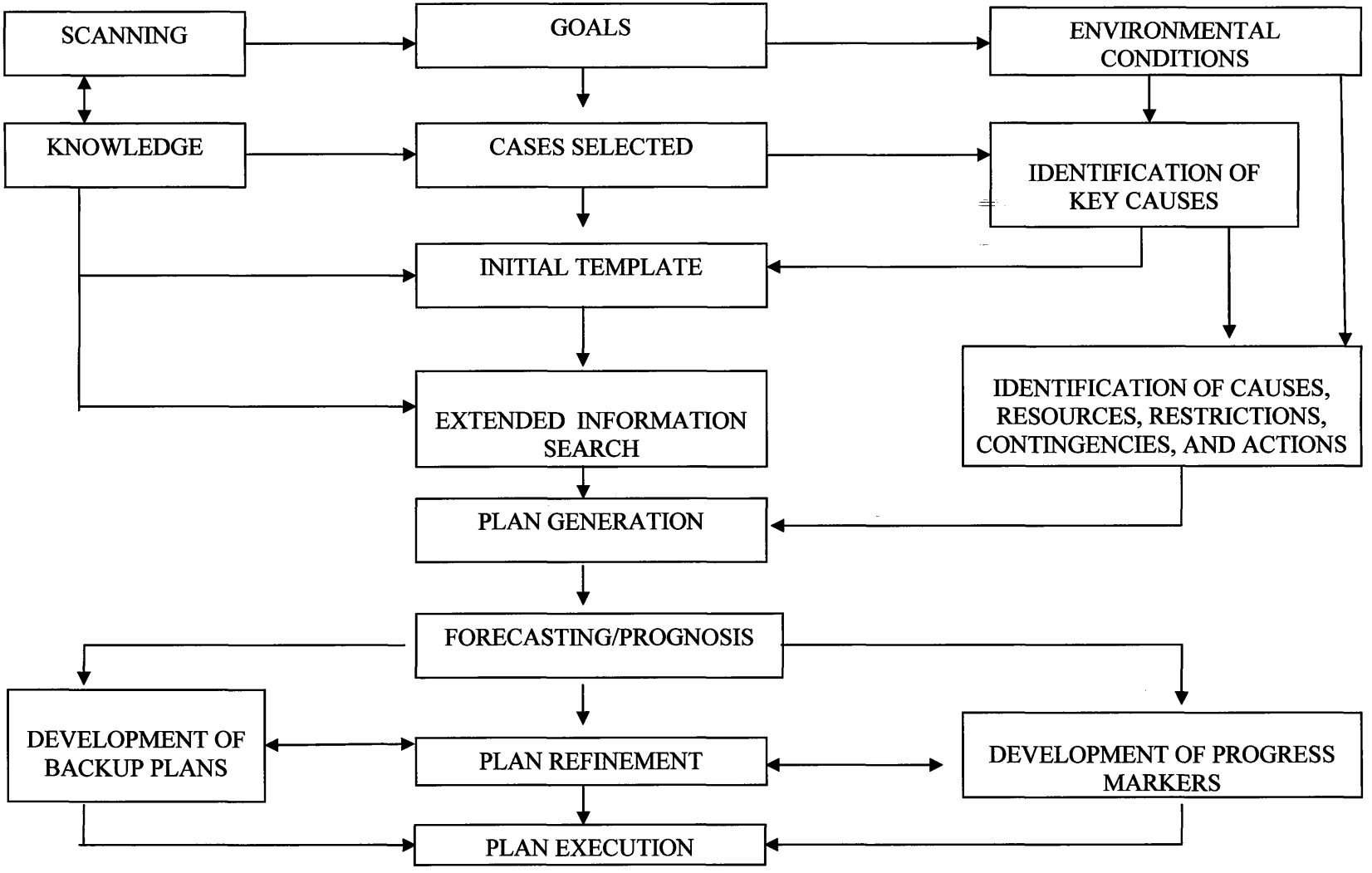

Table 1. Identification of Key Causes: Labels, Definitions, and Process Steps

Heuristic Label	Definition of Heuristic	Steps to Conduct Heuristic
Identify the Causes in a Scenario	Determine the factors that impact or influence other elements of a situation.	1. Identify the important factors or events in a situation that you need to manipulate in your plan. 2. Determine what activities preceded or accompanied that factor or event. 3. Of those activities, determine all the activities that could have had a relationship with the factor or event. 4. Determine any associated factors of those activities that could have had an impact on the factor or event.
Identify the Important Factors in a Scenario	Determine the causes that have a significant impact or influence on other elements of a situation.	1. Determine all the activities that precede or accompany a given event. 2. Of those activities, identify the ones that had a direct relationship with the event. 3. Eliminate the activities that only had a small impact on the event. 4. From those, identify the activities that must occur for the given event to occur.
Identify Causes that Have Multiple Outcomes	Determine the causes that influence more than one factor.	1. Identify the major events that are intended to occur during the implementation of a plan. 2. For each of these events, identify what other events or factors this planned event will impact. 3. Identify the major events that are not planned, but are likely to occur and the impact they will have on other factors or events. 4. Take the sum of the possible outcomes that could come from planned and unplanned events.
Identify Causal Factors that can be Manipulated	Determine causes that you are able to alter.	1. Identify the key causes that lead to the situation at hand. 2. Eliminate causes that are not under your control. 3. Eliminate causes you cannot easily act on because they take too much time or resources. 4. From the remaining causes, identify those causes you can easily act upon that will have a large effect on the situation.

Table 1 Continued.

Identify Indirect Outcomes of Key Causes	Determine the complex interactive effects of certain causes.	1. Determine the outcomes of the major causes that are influencing the current situation. 2. Determine how these outcomes will interact with the other causes in the situation. 3. Identify the outcomes that will result from these causes occurring or working together. 4. Assess how these new outcomes will change initial assessments of the actions you were planning.
Identify Dependent Causes	Determine the causes that must occur together to work properly.	1. Identify causes that occur together. 2. Determine whether these causes can occur independently of one another. 3. Of the causes that must occur together, identify the causes that are most important to the other dependent causes. 4. Of these causes, identify the cause that is most easily manipulated.
Rating Causes by Importance	Determine the causes occurring in a situation and rank them by least to most important	1. Identify all causes in a situation. 2. Identify causes that will have multiple outcomes in a situation. 3. Rate each cause on how many outcomes the cause has. 4. List the outcomes in order of most important to least important.

Table 2. Forecasting: Labels, Definitions, and Process Steps

Heuristic Label	Definition of Heuristic	Steps to Conduct Heuristic
Identify Positive Consequences	Determine how a plan will positively affect a given situation or the process of identifying all possible positive effects that a plan could have on a situation due to plan implementation.	1. First determine the most apparent or obvious positive consequences that are central to the plan. 2. Then look at the consequences and identify whether other positive consequences might result or be related to these positive consequences. 3. Then consider smaller less obvious positive consequences that could occur because of this plan. 4. List the positive consequences you have identified.
Identify Negative Consequences	Determine how a plan will negatively affect a given situation or the process of identifying all conceivable negative impacts that a plan could have on a situation due to plan implementation.	1. First determine the most apparent or obvious negative consequences that are likely from the plan. 2. Then look at the obvious negative consequences and identify whether other negative consequences might result or be related to these consequences. 3. Then consider smaller less obvious negative consequences that could occur because of this plan. 4. List the negative consequences you have identified.
Identify Critical Short-term Outcomes	Determine the outcomes of a plan that will occur in a relatively short time period that must be successfully completed in order for more long-term outcomes to occur.	1. Identify what are the ultimate objectives of the overall plan. 2. Determine sub-components of the ultimate objectives. 3. Determine what the long-term goals are based on these sub-components. 4. Determine what smaller items must be accomplished for these long term goals to be accomplished.
Identify Attainable Long-Term Outcomes	Determine the degree to which outcomes are likely to occur over an extended period of time based on one's ability to control the circumstances surrounding that outcome.	1. First, identify the main goals or objectives of the plan that will take a relatively long period of time to accomplish. 2. Of these objectives, identify the outcomes that greatly depend on the occurrence of events that appear to be beyond your control. 3. Identify short-term actions that are needed to attain these unlikely outcomes. 4. Then identify the environmental influences that would affect the strategies you would use to get to these long-term goals.

Table 2 Continued.

Identify Likely Contingencies or Restrictions	Determine the areas of a plan that are dependent upon other parts of the plan, a person, process or circumstance or are limited by outside factors.	1. First, identify the major steps in your plan. 2. Then, determine how the major steps fit together or go together. 3. Identify the resources or support you will need to execute each step. 4. Then, determine the conditions that should be present before you can implement each step as planned.
Identify Where Errors are Likely	Determine at what points during the implementation of a plan will the execution of the plan encounter obstacles or things that will likely go wrong.	1. First, identify sensitive, complex, or difficult parts of the plan. 2. Second, identify where mistakes are likely to occur due to sensitive, complex, or difficult parts of a plan. 3. Determine how easily it will be to recover from these mistakes. 4. Discard the mistakes that will be easily recovered and focus on the ones that are more serious in nature.
Identify Areas Requiring Back-up Plans	Determine what areas of a plan may need alternative plans.	1. Determine events or contingencies that might not occur in the implementation of the plan. 2. Determine the problems that might arise during plan implementation. 3. Identify actions that might be taken to remedy these problems. 4. Identify remedial actions that fit with the plan's long-term goals. 5. Identify actions that can be efficiently implemented given other planned activities.

Table 3: Overall Analysis of Covariance Summary Table

	Learning				Planning Skills				Performance			
	F	DF	P	η	F	DF	P	η	F	DF	P	η
Covariates												
Verbal Intelligence	14.35	1	.00 ***	.08	---	---	---	---	---	---	---	---
Self-learning Perception	3.84	1	.05 *	.02	8.07	1	.00 ***	.05	---	---	---	---
Pre test average	---	---	---	---	44.16	1	.00 ***	.22	---	---	---	---
Divergent Thinking Fluency	---	---	---	---	---	---	---	---	3.56	4, 153	.00 ***	.08
Main Effects												
Content	.05	1	.83	.00	.34	1	.56	.00	2.19	4, 153	.07 *	.05
Structure	5.01	2	.00 ***	.06	.29	2	.75	.00	1.85	4, 153	.12	.04
Two-Way Interactions												
Content X Structure	.69	2	.51	.00	.29	2	.75	.00	1.90	4, 154	.11	.05

Note:
F = F Ratio
DF = Degrees of Freedom
P = Significance Level (Determined by using Roy's Largest Root)
η = Effect Size
* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Table 4. Summary of Main Effects of Structure on Learning

	Case		Principle		Case and Principle					
	Mean	SE	Mean	SE	Mean	SE	F	DF	P	η
1) Overall	2.85	.09	3.20	.08	2.86	.09	5.01	2, 168	.01 ***	.06
2) Verbal Intelligence	2.84	.10	3.23	.09	2.89	.09	5.49	2	.01 ***	.07
3) Fluent Divergent Thinking	2.85	.09	3.15	.09	2.86	.09	3.26	2	.04 *	.04
4) Educational History	2.85	.09	3.19	.09	2.87	.09	4.28	1	.02 **	.05
5) Need for Cognition	1.37	.07	1.64	.06	1.52	.07	4.15	2	.02 **	.05
6) Learning Orientation	2.83	.09	3.26	.09	2.86	.09	6.71	2	.00 ***	.08
7) Performance Prove	2.89	.09	3.19	.09	2.86	.09	3.94	2	.02 **	.05
8) Performance Avoid	2.86	.09	3.20	.09	2.85	.09	2.68	2	.07 *	.03

Note:
SE = Standard Error
F = F Ratio
DF = Degrees of Freedom
P = Significance Level (Determined by using Roy's Largest Root)
η = Effect Size
* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Table 5: Analysis of Covariance with Verbal Intelligence as Grouping Variable

	Learning					Planning Skills					Performance				
	F	DF	P		η	F	DF	P		η	F	DF	P		η
Covariates															
Planning Pre-test	---	---	---		---	17.84	1	.00	***	.10	---	---	---		---
											2.63	4, 153	.04	**	.06
Main Effects															
Content	.13	1	.72		.00	1.10	1	.30		.01	2.24	4, 153	.07	*	.06
Structure	5.49	2	.01	***	.07	1.84	2	.16		.02	1.67	4, 153	.16		.04
Verbal Intelligence	8.23	1	.01	***	.05	7.19	1	.01	***	.04	1.77	4, 153	.14		.04
Two-Way Interactions															
Content x Structure	.58	2	.56		.01	.80	2	.45		.01	1.87	4, 154	.12		.05
Content x Verbal Intelligence	2.06	1	.15		.01	.04	1	.84		.00	1.06	4, 153	.38		.03
Structure x Verbal Intelligence	.23	2	.80		.00	2.06	2	.13		.03	.82	4, 154	.51		.02
Three-Way Interaction															
Content x Structure x Verbal Intelligence	2.72	2	.07	*	.03	.04	2	.96		.00	1.25	4, 154	.29		.03

Note:
F = F Ratio
DF = Degrees of Freedom
P = Significance Level (Determined by using Roy's Largest Root)
η = Effect Size
* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Table 6: Analysis of Covariance with Divergent Thinking Flexibility as a Grouping Variable

	Learning				Planning Skills				Performance				
	F	DF	P	η	F	DF	P	η	F	DF	P		η
Covariates													
Verbal Intelligence	12.12	1	.00 ***	.07	---	---	---	---	---	---	---		---
Pre test average	---	---	---	---	40.63	1	.00 ***	.21	---	---	---		---
Divergent Thinking Fluency	3.44	1	.07 *	.02	---	---	---	---	2.61	4, 153	.04	**	.06
Self-learning Perception	4.98	1	.03 **	.03	7.31	1	.01 ***	.05	---	---	---		---
Main Effects													
Content	.41	1	.52	.00	.13	1	.72	.00	1.64	4, 153	.17		.04
Structure	2.27	2	.11	.03	.54	2	.58	.01	1.88	4, 154	.12		.05
Divergent Thinking Flexibility	2.09	1	.15	.01	1.76	1	.19	.01	1.08	4, 153	.37		.03
Two-Way Interactions													
Content X Structure	.63	2	.54	.01	.56	2	.57	.01	1.99	4, 154	.10	*	.05
Content X Divergent Thinking Flexibility	.01	1	.91	.00	.01	1	.93	.00	.62	4, 153	.65		.02
Structure X Divergent Thinking Flexibility	.39	2	.68	.01	1.30	2	.28	.02	1.52	4, 154	.20		.04
Three-Way Interactions													
Content X Structure X Divergent Thinking Flexibility	2.77	2	.07 *	.04	.31	2	.74	.00	3.23	4,154	.01 **		.08

Note:

F = F Ratio

DF = Degrees of Freedom

P = Significance Level (Determined by using Roy's Largest Root)

η = Effect Size

* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Table 7: Analysis of Covariance with Divergent Thinking Fluency as Grouping Variable

	Learning				Planning Skills				Performance				
	F	DF	P	η	F	DF	P	η	F	DF	P		η
Covariates													
Verbal Intelligence	14.73	1	.00 ***	.09	---	---	---	---	---	---	---		---
Self-learning Perception	3.31	1	.07 *	.02	---	---	---	---	---	---	---		---
Pre test average	---	---	---	---	44.76	1	.00 ***	.22	---	---	---		---
Main Effects													
Content	.06	1	.80	.00	.00	1	.97	.00	2.02	4, 153	.10	*	.05
Structure	3.69	2	.03 **	.05	.60	2	.55	.01	1.50	4, 154	.21		.04
Divergent Thinking Fluency	1.18	1	.28	.01	1.85	1	.18	.01	3.14	4, 153	.02	**	.08
Two-Way Interactions													
Content X Structure	.56	2	.57	.01	.34	2	.72	.00	2.22	4, 154	.07	*	.05
Structure X Fluency	.02	1	.89	.00	1.19	2	.31	.02	2.61	4, 153	.04	*	.06
Content X Fluency	.24	2	.78	.00	.01	1	.94	.00	.74	4, 154	.57		.02
Three-Way Interactions													
Content X Structure X Fluency	2.81	2	.06 *	.04	1.49	2	.23	.02	5.92	4,154	.00	***	.13

Note:

F = F Ratio

DF = Degrees of Freedom

P = Significance Level (Determined by using Roy's Largest Root)

η = Effect Size

* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Table 8: Analysis of Covariance with Need for Cognition as Grouping Variable

	Learning				Planning Skills				Performance			
	F	DF	P	η	F	DF	P	η	F	DF	P	η
Covariates												
Verbal Intelligence	12.03	1	.00 ***	.07	---	---	---	---	---	---	---	---
Learning Orientation	5.47	1	.02 **	.03	---	---	---	---	---	---	---	---
Pre test average	---	---	---	---	40.23	1	.00 ***	.21	---	---	---	---
Divergent Thinking Fluency	---	---	---	---	---	---	---	---	3.16	4, 153	.02 **	.08
Self-learning Perception	5.21	1	.02 **	.03	5.04	1	.03 **	.03	---	---	---	---
Main Effects												
Content	.00	1	.99	.00	1.05	1	.31	.01				
Structure	3.22	2	.04 **	.04	.30	2	.74	.00	2.12	4, 153	.02 **	.08
Need for Cognition	2.88	1	.09 *	.02	2.98	1	.09 *	.02	1.52	4, 154	.20	.04
									2.12	4, 153	.08 *	.05
Two-Way Interactions												
Content X Structure	1.56	2	.21	.02	.52	2	.60	.01	1.66	4, 154	.16	.04
Content X Need for Cognition	2.38	1	.13	.02	.01	1	.91	.00	.68	4, 153	.61	.02
Structure X Need for Cognition	.04	2	.97	.00	1.32	2	.27	.02	1.07	4, 154	.37	.03
Three-Way Interactions												
Content X Structure X Need for Cognition	4.02	2	.02 **	.05	1.02	2	.37	.01	2.97	2, 154	.02 **	.07

Note:

F = F Ratio

DF = Degrees of Freedom

P = Significance Level (Determined by using Roy's Largest Root)

η = Effect Size

* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Table 9: Analysis of Covariance with Goal Orientation: Performance Avoid as Grouping Variable

	Learning				Planning Skills				Performance			
	F	DF	P	η	F	DF	P	η	F	DF	P	η
Covariates												
Need for Cognition	---	---	---	---	---	---	---	---	2.68	4, 152	.03 **	.07
Verbal Intelligence	---	---	---	---	---	---	---	---	---	---	---	---
Pre test average	---	---	---	---	42.62	1	.00 ***	.22	---	---	---	---
Self-learning Perception	4.21	1	.04 *	.03	14.98	1	.01 ***	.05	3.26	4, 152	.01 **	.08
Main Effects												
Content	.20	1	.66	.00	.14	1	.71	.00	2.06	4, 152	.09 *	.05
Structure	4.91	2	.01 **	.06	.98	2	.38	.01	2.22	4, 153	.07 *	.06
Performance Avoid	.01	1	.91	.00	.32	1	.57	.00	.76	4, 152	.55	.02
Two-Way Interactions												
Content X Structure	.76	2	.47	.01	.44	2	.64	.01	1.73	4, 153	.15	.04
Content X Performance Avoid	.28	1	.60	.00	.37	1	.55	.00	.36	4, 152	.84	.01
Structure X Performance Avoid	1.42	2	.24	.02	.32	2	.72	.00	2.19	4, 153	.07 *	.05
Three-Way Interactions												
Content X Structure X Performance Avoid	1.79	2	.17	.02	.63	2	.53	.01	3.19	4, 153	.02 **	.08

Note:

F = F Ratio

DF = Degrees of Freedom

P = Significance Level (Determined by using Roy's Largest Root)

η = Effect Size

* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Table 10: Summary of Main Effects of Content on Planning Performance

	Causes		Forecasting					
	Mean	SE	Mean	SE	F	DF	P	η
1) Verbal Intelligence Practicality	3.42	.07	3.15	.07	6.627	1,168	.01 **	.04
2) Fluent Divergent Thinking Practicality	3.41	.07	3.16	.07	6.086	1,168	.02 **	.04
3) Educational History Practicality	3.42	.07	3.15	.07	6.565	1,168	.01 **	.04
4) Need for Cognition Practicality	3.42	.07	3.16	.07	6.927	1,168	.01 ***	.04
5) Learning Orientation Practicaliyt	3.44	.07	3.16	.07	7.528	1,168	.01 ***	.05
6) Performance Prove Practicality	3.45	.07	3.15	.07	8.428	1,168	.00 ***	.05
7) Performance Avoid Practicality	3.42	.07	3.15	.07	6.618	1,168	.01 **	.04

Note:
SE = Standard Error
F = F Ratio
DF = Degrees of Freedom
P = Significance Level (Determined by using Roy's Largest Root)
η = Effect Size
* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Table 11: Summary of Significant Analysis of Covariance for the Performance Scales with different Grouping Variables

	Practicality				Elegance				Originality				Quality			
	F	DF	P	η	F	DF	P	η	F	DF	P	η	F	DF	P	η
Grouping Variables																
Flexibility																
Content X Structure	3.37	2	.04 **	.04	---	---	---	---	---	---	---	---	---	---	---	---
Content X Structure X Flexibility	---	---	---	---	---	---	---	---	3.99	2	.02 **	.05	---	---	---	---
Need for Cognition																
Cognition	---	---	---	---	3.05	2	.05 *	.04	5.37	2	.01 ***	.06	3.15	2	.05 **	.04
Divergent Thinking Fluency																
Content X Structure	3.91	2	.02 **	.05	---	---	---	---	---	---	---	---	---	---	---	---
Content X Structure X Fluency	---	---	---	---	---	---	---	---	5.89	2	.00 ***	.07	---	---	---	---
Performance Avoid																
Content X Structure X Performance Avoid	---	---	---	---	5.44	2	.01 ***	.07	---	---	---	---	3.35	2	.04 **	.04

Note:
F = F Ratio
DF = Degrees of Freedom
P = Significance Level (Determined by using Roy's Largest Root)
η = Effect Size
* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Table 12: Analysis of Covariance with Goal Orientation: Performance Prove as Grouping Variable

	Learning				Planning Skills				Performance			
	F	DF	P	η	F	DF	P	η	F	DF	P	η
Covariates												
Learning Orientation	3.318	1	.07 *	.02	---	---	---	---	---	---	---	---
Verbal Intelligence	12.834	1	.00 ***	.08	---	---	---	---	---	---	---	---
Pre test average	---	---	---	---	38.41	1	.00 ***	.20	---	---	---	---
Divergent Thinking Fluency	---	---	---	---	---	---	---	---	3.25	4, 153	.01 **	.08
Self-learning Perception	3.910	1	.05 *	.03	---	---	---	---	---	---	---	---
Main Effects												
Content	.113	1	.74	.00	.15	1	.70	.00	2.56	4, 153	.04 *	.06
Structure	3.944	2	.02 **	.05	.67	2	.52	.01	1.51	4, 154	.20	.04
Performance Prove	.920	1	.34	.01	.39	1	.54	.00	1.90	4, 153	.11	.05
Two-Way Interactions												
Content X Structure	1.081	2	.34	.01	.05	2	.95	.00	1.78	4, 154	.14	.04
Content X Performance Prove	.171	1	.68	.00	1.49	1	.23	.01	2.56	4, 153	.04 **	.06
Structure X Performance Prove	.699	2	.50	.01	2.00	2	.14	.03	2.04	4, 154	.09 *	.05
Three-Way Interactions												
Content X Structure X Performance Prove	1.048	2	.35	.01	.90	2	.41	.01	1.56	4,154	.19	.04

Note:

F = F Ratio

DF = Degrees of Freedom

P = Significance Level (Determined by using Roy's Largest Root)

η = Effect Size

* = $p \leq .10$, ** = $p \leq .05$, *** = $p \leq .01$

Appendix A. Heuristic Explanation Sheet

Identify the Causes in a Scenario

Read the following information very carefully.

What is it?

Identifying the causes in a scenario is to determine the factors that impact or influence other elements of a situation.

Why is it important?

It is natural for us, as human beings to ask why something occurs. Essentially, when we ask why something occurs we are trying to determine the cause of that event. When you are planning, it is important to make a deliberate effort to determine the causes of situations.

Identifying causes helps to determine why certain things are occurring. Most often, we have to know why something is occurring in order to manipulate it. For example, if I don't know why the child is crying (she's hungry), I don't know what to do to keep her from crying (feed her). Therefore, identifying the causes that are influencing a situation is crucial to a planner's success. Once causes are identified, plans can be drawn to address those causes.

How do I identify the causes in a scenario?

Step 1
Identify the important factors or events in a situation that you need to manipulate in your plan.
Step 2

Determine what activities preceded or accompanied that factor or event.

Step 3

Of those activities, determine all the activities that could have had a relationship with the factor or event.

Step 4

Determine any associated factors of those activities that could have had an impact on the factor or event.

Appendix B. Example of Multiple Choice Questions

Identifying Causes Questions:

Read the question and the corresponding answers. Circle the letter next to the best answer for the question. Circle only one answer unless indicated otherwise.

1. When we determine the cause of an event we determine:
    a. When it occurred
    b. Why it occurred
    c. What exactly occurred
    d. Who it occurred with
2. Determining the cause of an event helps the planner to
    a. Determine what happens next
    b. Know when the event happened
    c. Know how to react to the event
    d. Determining the most influencing factor in the situation
3. A cause:
    a. Is the foundation of an event or situation
    b. Always acts in the company of other causes
    c. Is the single most influencing factor in a given situation
    d. Is a factor that influences other factors
4. To determine the cause of an event you must (pick 2)
    a. Figure out what things occurred at the same time as that event
    b. Determine what happened before the event
    c. Find out if people wanted that event to occur
    d. Determine what impact that event had on its surroundings
    e. Find out if that event has occurred more than once

Appendix C. Sample of Multiple Choice Answer Key

Answers to the Identify Causes Questions:



Check your answers using the following answer key. The correct answers are in bold.

1. When we determine the cause of an event we determine:
    a. When it occurred
    b. Why it occurred
    c. What exactly occurred
    d. Who it occurred with
2. Determining the cause of an event helps the planner to
    a. Determine what happens next
    b. Know when the event happened
    c. Know how to react to the event
    d. Determining the most influencing factor in the situation
3. A cause:
    a. Is the foundation of an event or situation
    b. Always acts in the company of other causes
    c. Is the single most influencing factor in a given situation
    d. Is a factor that influences other factors
4. To determine the cause of an event you must (pick 2)
    a. Figure out what things occurred at the same time as that event
    b. Determine what happened before the event
    c. Find out if people wanted that event to occur
    d. Determine what impact that event had on its surroundings
    e. Find out if that event has occurred more than once

Appendix D. Case-based Instruction Example

Case Study: Identify Causes that have Multiple Outcomes

Danni's Burgers is a fast food chain in the Northwestern United States. Danni's Burgers mainly sell hamburgers, chicken sandwiches, French fries, and a variety of desserts. Danni's provides a child and family friendly environment with playgrounds and child meals with prizes. However, they also target the young adult population with deluxe burgers that are very cost efficient. The chain has been in operation for 20 years. The owner of Danni's Burgers, Ray Dasani started the chain when he was in his late 30's and named it after his only child, Danni. Recently, Ray's first grandchild was born. Consequently, Ray has decided that his restaurants need to be more environmentally friendly.

Ray plans for the fast food chain to change from all plastic and Styrofoam products to paper products where possible. He would like to encourage recycling in his stores. This will include Danni's employees recycling as well as its customers. He plans to create separate trash receptacles and encourage his customers to separate their trash (i.e. plastic forks from paper cups) for recycling. Danni's will implement a policy for all employees to separate trash and recycle all large containers that are used to deliver products or hold cleaning products (i.e. plastic bottles or large cardboard boxes).

This change in procedure required training for all Danni's employees to teach them how to use the new recyclable products as well as how to identify and properly dispose of recyclable items. Employees were trained how to package different products using paper instead of Styrofoam. For example, they were taught how to wrap burgers in paper properly, sleeve cups that have hot drinks, and how to separate trash for recycling.

Ray knew that the employees and customers alike could have a negative reaction to the changes. Customers could view this as an added hassle that does not coincide with the fast food convenience. Many customers also prefer their drinks in Styrofoam cups because these cups do no sweat. Some customers would be very upset that Danni's decided to change from Styrofoam to paper. To address these issues, Ray knew the reasons for the changes must be communicated to the customers for them to accept them. Ray started a publicity campaign to make people more aware of environmental problems and the dangers of pollution and landfills. He advertised his company as one who was taking responsibility now for the future. He advertised his company as one who was proving their family allegiance and made a plea to families to help Danni's help the environment.

Ray came up with the total possible outcomes that could come from the decision to be more environmental friendly. He decided the possible effects were employees packaging materials incorrectly, employees not knowing how to recycle other materials, customers not knowing how to recycle, arranging for special pick ups of the trash, and customers being upset at the changes. Ray prepared for each of these outcomes. Although the transition from Styrofoam and other changes were not easy, the transition went well and Danni's Hamburgers was listed as one of the latest environmentally friendly companies in the nation.

How does the principle apply?

Point 1

Ray identified the major events that would occur would be changing from all plastic and Styrofoam products to paper products, creating separate trash receptacles, implement a policy for all employees to separate trash and recycle all large containers.

Point 2

Ray knew that his employees would require training on packaging products using paper and how to recycle trash properly.

Point 3

Ray thought that customers might have a negative reaction to the changes. He thought this could possibly affect sales. He was also aware that costs might slightly increase due to the recycling procedures.

Point 4

Ray identified all the possible outcomes: employees will not package products correctly, employees will not recycle trash properly, customers might have a negative reaction to the changes, possible reduction in sales, and costs might slightly increase due to the recycling procedures. Appendix D. Principle-based Instruction Example

Appendix E. Principle-based Instruction Example

Steps to Identify Causes that have Multiple Outcomes

Example:
Danni's Burgers is a fast food chain in the Northwestern United States. Danni's Burgers mainly sell hamburgers, chicken sandwiches, French fries, and a variety of desserts. The chain has been in operation for 20 years. They are well known for their specialty drinks. The owner of Danni's Burgers, Ray Dasani has decided that his restaurants need to be more environmentally friendly.

Step 1 Identify the major events that are intended to occur during the implementation of a plan.
Danni's will change from all plastic and Styrofoam products to paper products where possible. Danni's will create separate trash receptacles and encourage customers to separate their trash (i.e. plastic forks from paper cups) for recycling. Danni's will also implement a policy for all employees to separate trash and recycle all large containers that are used to deliver products or hold cleaning products (i.e. plastic bottles or large cardboard boxes).

Step 2 For each of these events, identify what other events or factors this planned event will impact.
This change in procedure required training for all Danni's employees to teach them how to use the new recyclable products as well as how to identify and properly dispose of recyclable items. Employees were trained how to package different products using paper instead of Styrofoam. For example, they were taught how to wrap burgers in paper properly, sleeve cups that have hot drinks, and how to separate trash for recycling.

Step 3 Identify the major events that are not planned, but are likely to occur and the impact they will have on other factors or events.
Ray knew that the employees and customers alike could have a negative reaction to the changes. To address these issues, Ray knew the reasons for the changes must be communicated to the customers for them to accept them. Ray started a publicity campaign to make people more aware of environmental problems and the dangers of pollution and landfills. He advertised his company as one who was taking responsibility now for the future.

Step 4 Take the sum of the possible outcomes that could come from planned and unplanned events.
The total possible outcomes that could come from the environmental changes were employees packaging materials incorrectly, employees not knowing how to recycle other materials, customers not knowing how to recycle, arranging for special pick ups of the trash, and customers being upset at the changes.

Appendix F: Summary of Significant Interactions with Learning as the Outcome

	Causes												Forecasting											
	Case				Principle				Case and Principle				Case				Principle				Case and Principle			
	Low		High		Low		High		Low		High		Low		High		Low		High		Low		High	
	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE
Content x Structure x Verbal Intelligence	2.91	.21	2.79	.18	3.54	.19	2.98	.17	2.90	.22	2.67	.17	2.57	.17	3.07	.20	3.09	.20	3.33	.16	2.66	.18	3.32	.19
Content x Structure x Flexible Divergent Thinking	2.96	.18	2.83	.21	2.72	.24	3.41	.15	2.76	.22	2.83	.19	2.63	.18	2.98	.20	3.16	.16	3.17	.22	2.82	.19	3.16	.19
Content x Structure x Fluent Divergent Thinking	3.10	.18	2.69	.20	3.00	.20	3.30	.16	2.87	.20	2.64	.19	2.81	.17	2.82	.19	3.33	.16	2.96	.20	2.97	.19	2.98	.18
Content x Structure x Need for Cognition	1.39	.12	1.60	.17	1.69	.14	1.57	.11	1.35	.13	1.62	.14	1.31	.13	1.18	.13	1.51	.13	1.78	.12	1.67	.15	1.45	.12
Content x Structure x Performance Avoid	2.93	.18	2.90	.20	3.23	.17	3.14	.18	2.80	.16	2.65	.23	2.99	.18	2.64	.17	3.28	.21	3.15	.15	2.63	.18	3.33	.18

Note:

M = Mean

SE = Standard Error

Appendix G: Summary of Significant Three-way Interactions with Performance as the Outcome

	Causes												Forecasting											
	Case				Principle				Case and Principle				Case				Principle				Case and Principle			
	Low		High		Low		High		Low		High		Low		High		Low		High		Low		High	
	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE
Content X Structure X Flexibility																								
Rating Scale: Originality	3.12	.21	2.70	.248	3.555	.280	2.959	.180	2.714	.257	3.114	.216	2.928	.204	2.873	.234	2.953	.190	3.202	.262	3.112	.221	2.647	.225
Content X Structure X Need for Cognition																								
Rating Scale: Originality	2.73	.19	3.41	.28	2.78	.23	3.38	.19	3.21	.21	2.69	.24	2.93	.20	2.84	.21	2.99	.21	3.04	.20	2.54	.24	3.11	.19
Rating Scale: Quality	2.42	.17	3.29	.26	2.69	.21	3.24	.17	3.02	.19	2.82	.22	2.75	.19	2.90	.20	2.95	.20	2.95	.19	2.48	.22	2.90	.18
Rating Scale: Elegance	2.58	.19	3.31	.28	2.66	.23	3.34	.19	3.13	.21	2.90	.24	2.80	.21	2.77	.21	3.11	.21	3.04	.20	2.48	.24	2.83	.19
Content X Structure X Fluency																								
Rating Scale: Originality	2.88	.21	3.02	.23	3.41	.24	3.01	.18	2.52	.23	3.53	.21	2.59	.20	3.15	.22	2.75	.18	3.36	.24	2.91	.22	2.89	.21
Content X Structure X Performance Avoid																								
Rating Scale: Quality	2.88	.20	2.54	.21	2.85	.18	3.24	.20	2.92	.18	3.05	.25	2.69	.20	2.91	.19	3.14	.23	2.86	.16	2.30	.20	3.05	.20
Rating Scale: Elegance	3.05	.21	2.59	.23	2.85	.20	3.34	.21	3.04	.19	3.08	.26	2.56	.21	2.97	.20	3.35	.25	2.94	.18	2.26	.21	3.03	.21

Note:

M = Mean

SE = Standard Error

Appendix H: Summary of Significant Two-way Interactions with Performance as the Outcome

	Cause				Forecast				Case				Principle				Case and Principle			
	Low		High		Low		High		Cause		Forecast		Cause		Forecast		Cause		Forecast	
	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE
Content X Structure (with Divergent Thinking Flexibility)																				
Rating Scale: Practicality	---	---	---	---	---	---	---	---	3.19	.13	3.22	.13	3.52	.13	3.40	.13	3.50	.13	2.89	.13
Content X Structure (with Divergent Thinking Fluency)																				
Rating Scale: Practicality	---	---	---	---	---	---	---	---	3.20	.13	3.21	.12	3.50	.12	3.38	.12	3.54	.13	2.54	.23
Content X Performance Prove																				
Rating Scale: Originality	2.81	.13	3.24	.13	2.97	.12	2.87	.12	---	---	---	---	---	---	---	---	---	---	---	---
Rating Scale: Quality	2.60	.12	3.20	.12	2.87	.11	2.78	.11	---	---	---	---	---	---	---	---	---	---	---	---
Rating Scale: Elegance	2.63	.12	3.33	.12	2.87	.12	2.82	.12	---	---	---	---	---	---	---	---	---	---	---	---

Note:

M = Mean

SE = Standard Error

Appendix I. Criterion Rating Scale Definitions

Rating Scale 1: Practicality

Practicality Definition:

The degree to which the plan is capable of being put to use. The plan is feasible. It is not difficult to implement. It does not require an unreasonable amount of coordination and does not require too many resources.

Practicality Considerations

The subject's answers should be evaluated (rated on a scale from 1 to 5) using the following dimensions:

Realistic/Reasonable – Can the idea(s) actually be put into use? Did the person avoid excesses/extremes?
Logical – Do the ideas make rational sense?
Ask Yourself – Does this plan require such extraordinary events that I don't think it would be worth doing?

(1) Plan is not capable of being accomplished. The capabilities of fulfilling the goals are seemingly impossible. Ideas are imaginative and creative, but not true to life.

- *My first plan of action would be to remove the school from its metropolitan setting and put it into a more rural setting.*
- *The students will be tested over the material in groups.*

(2) Plan is either too costly or too strategically challenging to implement today. Ideas may work in time but not for this goal for this year.

(3) Plan is possible, but goals are somewhat idealistic. Minor cases of extremes/excesses seen, but most of the ideas avoid this. Ideas would be difficult to accomplish but not impossible.

- *We could have teachers double as counselors*
- *Teachers will be assigned to different students according to their academic performance.*

(4) Plan has no excesses/extremes. Idea is doable with extra work on the part of the implementers to overcome gaps in the flow of the parts of the plan.

(5) Plan is "tight" in that subject is able to explain how all the parts of the plan will come together and work to reach a finished product. Excesses/extremes are avoided completely and the plan can be implemented with no difficulty. No misunderstanding of what steps should be taken and when.

- *I think it would be best for students to have a teacher that tries to get students into the class. For example, they could just call on students to answer questions or complete the teacher's sentence, or maybe have them work a math problem on the board in front of the class. Also, in the science class, the teacher can somewhat entertain the students while still teaching with experiments that will get their attention. Group projects would also be helpful, but I would have the students answer on their own first, then put them in groups and discuss their answers.*

Rating Scale 2: Originality

Originality Definition
The degree to which a plan is independent in thought. The plan is unique and uncommon. It is different then most answers in that it provides a new outlook to the problem. Many times it will build on items that are often times overlooked by others. Originality is not judged for feasibility.

Originality Considerations
The subject's answers should be evaluated (rated on a scale from 1 to 5) using the following dimensions:

Unexpected – Did they approach the problem in a novel, imaginative, unpredictable, or innovative manner?
Newness – Did they go beyond the stimulus materials provided to include additional material and experiences?
Ask Yourself – Is this plan distinctive and unusual from other answers?
Note – You may need to become familiar with a good number of sample answers before you are able to rate this scale.

(1) Very predictable, plan is prevalent in most answers. Plan uses just the information and ideas provided. Plan does not introduce any new ideas.

- *Make learning fun*
- *I would use the curriculum that was given*
- *Hire good teachers*

(2) Plan includes a very basic piece of information not provided in the original material, perhaps used to illustrate a single aspect of the plan.

(3) This plan is different but it is also seen in a good number of answers. While the plan is not routine, the plan is also not distinctive. The subject may use new information, but information seems general, not specific to the subject.

- *The grade level that presents the most improvement will have a day out of school on an assigned field trip.*
- *Individuals will be assigned to debate issues they have learned*

(4) Plan has a 'twist,' something that makes it different, but builds upon a typical business foundation. Subject includes some information that is not in the materials, but does not go far beyond it (simple elaboration).

(5) Plan includes a large amount of information that is unique and not given in the original materials. Ideas are rarely or never seen in other answers.

- *The students should be randomly assigned to groups. This assignment should be random because otherwise social dynamics might create negative consequences through preferential treatment within groups. . . assign students to groups, give them necessary background lecture, give them an assignment then have the group deliberate on allocation of resources*
- *Since tests focus on writing skills, reading comprehension, mathematic skills, and analytic skills and can't teach all those in the same class, I propose the idea of a school wide academic bowl. The bowl would include questions and parts to relate to all areas of the test . . . The points achieved in the bowl will be tagged to the student's grades.*

Rating Scale 3: Quality

Quality Definition
The degree to which a plan provides a comprehensive strategy that will meet all the intended goals. It is the overall usefulness and effectiveness of the plan. The plan targeted the problem at hand. The plan will distinguish itself from other plans in that it will seem most likely to succeed.

Quality Considerations
The subject's answers should be evaluated (rated on a scale from 1 to 5) using the following dimensions:

Completeness – Did they understand the instructions, use the information, and follow the instructions fully and completely with enough detail to understand it?

Effectiveness – Is the plan likely to produce the desired outcome?
Ask Yourself – Is the plan logical, systematic and well thought out?

(1) Missing information or incomplete plan. Plan would not have the desired outcome. Major deficiencies in the details of the plan which causes questions as to how the plan is projected to happen. It would be very difficult to implement this pan because the plan does not spell out what to do. The plan seems most likely to fail.

- *Hire qualified teachers to teach to the test*
- *My plan for the school isn't' very organized I do whatever and whenever*
- *I'm not sure what I would do*

(2) One major piece of information or several minor ones are missing from the plan or major step is not included. Most likely, the majority of the desired outcomes will not be attained. Key parts of the plan are fuzzy and unclear.

(3) A few minor steps are missing from the plan or are vague and yet are necessary to the plan to work completely. Major parts of the plan are clear, but several parts are ambiguous. Major aspects of the desired outcome are likely to be achieved.

- *"One teaching strategy that should be implemented is to have everyone respond to the same answers individually. The teacher asks the question and everyone writes a response. When everyone finishes they are read aloud. Then the students may debate the ideas and each student is forced to defend their argument."*

(4) One or two parts minor parts of the plan are missing or vague, but none that are central to the answer. Most of the desired outcomes are likely to occur.

(5) Plan has enough detail to give a complete picture of what will occur. All of the desired outcomes are likely. Plan is likely to succeed because it is well thought out and targets the needed goals.

- *I would teach the kids to learn not to get a higher rating. I would have more field trips so that the kids would have more hand on experiences, I would also have expertise in the fields of study come to tell the kids more in depth, interesting things about the subjects that they are learning about. I would have "tell the principle" days where students or teachers or even parents could tell me what I was doing right and wrong.*

Rating Scale 4: Elegance

Elegance Definition
The degree to which the plan is put together well. The ideas of the plan are written well. Ideas are backed up with strategies on how to achieve those goals. The design is smooth and flows together well. Someone who reads this plan can picture the plan coming together with ease.

Elegance Considerations
The subjects answers should be evaluated (rated on a scale from 1 to 5) using the following dimensions:

Fit - Do elements of the model fit together?
Organization - Are the exercises/activities and instruction organized in such a way to optimize learning?
Focus - Are the material activities and instruction focused on the key goals of the experimental school (providing a new way to facilitate the best learning)?
Ask Yourself – Does the plan focus on key issues and can you see it being implemented with ease?

(1) The plan is disjointed and doesn't articulate any clear strategies. The plan will be very difficult to implement.

- *My plan is one that has not been tested for errors though some can be seen. The program I want to implement allows for both stimulation of student and student teacher relationship but it also has some loop holes. Yes it does allow for cheating but daily quizzes and class (mandatory) participation will ensure that studying occurs. It will be a challenge especially since its success relies upon team work and good relationships between students and teachers*

(2) The plan is mostly disjointed and doesn't articulate many clear strategies. It is difficult to envision the implementation of this plan.

(3) The plan seems to follow a logical progression, but it doesn't have totally harmonious components; some of its activities will flow together, but most are not comprehensive enough to ensure implementation.

- *I think the first and most important step is to hire high quality teachers. The teachers need to be able to motivate the students to learn... Critical thinking and good teachers will make the school a success.*

(4) The plan follows a logical progression, and is fairly detailed. It still doesn't have totally harmonious components; but it is comprehensive enough to ensure adequate implementation.

(5) The plan completely details a logical school model. The activities designed by the subject will work well together and are focused on enhancing learning. This new model is well organized and will facilitate meeting the key goal of raising standardized test scores

- *In my goal of putting Oklahoma's education ranking in the top percentile, I would implement a curriculum based on the test given by the NEA. The scores of the first test would determine the level of education the student would receive. The main goal is to have each student at the same knowledge level by the end of the year. . I would implement my own test half way through the year to see student comprehension. The students would then be placed into new classes to refine their failing skills.*