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ScienceDirect
Learning and Individual Differences 18 (2008) 390–401
Learning and Individual Differences
www.elsevier.com/locate/lindif

Understanding individual problem-solving style: A key to learning and applying creative problem solving ☆

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Received 13 March 2007; received in revised form 17 November 2007; accepted 23 November 2007

Abstract

More than five decades of research and development have focused on making the Creative Problem Solving process and tools accessible across a wide range of ages and contexts. Recent evidence indicates that when individuals, in both school and corporate settings, understand their own style of problem solving, they are able to learn and apply process tools more effectively, and when teams appreciate the styles of their individual members, their problem solving efforts are enhanced. We summarize recent studies and report new data supporting the conclusion that individual style differences provide an important key to understanding the interaction of person, process, product, and press when managing change.

Keywords: Creativity; Problem solving; Style; Thinking

The purpose of this article is to examine briefly the emerging construct of problem-solving style in relation to recent advances in research, theory, and practice on Creative Problem Solving (CPS). We review and update models for understanding CPS and problem-solving style. We also discuss an assessment tool for problem-solving style and identify the implications of problem-solving style and its interaction with CPS for research and practice relating to effective learning and teaching of creativity and problem solving.

1. Problem solving

As a foundation for examining CPS and problem-solving style, we must first define problem solving itself and the link between problem solving and creativity. A comprehensive review of the psychological literature on problem solving is beyond the scope of this article, but has been addressed in numerous other sources (e.g., Chang, D'Zurilla & Sanna, 2004; Newell & Simon, 1972; Smyth, Morris, Levy, & Ellis, 1987; Sternberg, 1994; Sternberg & Frensch, 1991; Voss, 1989; Ward, Smith & Vaid, 1997). For our present purposes, we will focus specifically on research that has informed and guided our understanding and development of both CPS and problem-solving style.

A problem represents a gap between where we are or what we have, and a desired location or outcome. Johnson (1972, p. 133) indicated that "… a problem arises when a person is motivated toward a goal and his first attempt to reach it is unrewarding." Problems can also be understood more broadly as questions for inquiry. Problem solving is the thinking and behavior we engage in to obtain the desired outcome we seek. The outcome could be attaining a certain goal or finding a satisfactory answer to our question.

This broad conception of problem solving raises two main implications. The first of these is the problem associated with the word "problem." A popular connotation is that problems are negative; things to be avoided. Many prefer to use more positive terms like goals, aspirations, opportunities, challenges, or visions. We see all these concepts included within our definition of problem solving. The tendency to focus more on the actual current reality, or the "other side of the gap" may be an essential feature distinguishing between these views.

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1041-6080/$ - see front matter © 2007 Elsevier Inc. All rights reserved.
doi:10.1016/j.lindif.2007.11.007

Another implication is the inherent contrast between creativity and problem solving. Many writers have attempted to outline conceptual and operational distinctions and relationships between these two constructs (e.g., Guilford, 1977; Rugg, 1963; Runco, 2007). Newell, Shaw and Simon (1962, p. 63) described the relationship by stating: "Creative activity appears . . . simply to be a special class of problem solving activity characterized by novelty, unconventionality, persistence, and difficulty in problem formulation."

Isaksen (1995) provided three continua that outline the distinctions and relationships between creativity and problem solving. A problem area or task definition can be clearly defined and structured or it can be fuzzy, ill-defined, and ambiguous. The former is served by problem solving, the latter by a creative kind of problem solving or problem finding (Carson & Runco, 1999; Getzels & Csikszentmihalyi, 1976). The way to obtain the solution or the solution pathway or method can be known, predetermined, and relatively simple, or it can be unknown, complex and non-determined. The former is more a function of memory, expertise and knowledge. The latter requires creativity of thought (Geary, 2005; Kirton, 2003). The desired outcome can already exist or be readily available, or might not exist or be currently available. The former situation calls for focused inquiry. The latter calls for creativity and inventiveness (Beer & Nohria, 2000; Bossidy & Charan, 2002).

These distinctions and relationships have led to the development of Creative Problem Solving, a framework that is based on more than 50 years of research and development.

2. Creative problem solving

Over the course of the past five decades, many researchers and developers presented a variety of different models of, or approaches to, creative problem solving, in varied settings that include colleges and universities, elementary and secondary schools, small and large businesses, and numerous consulting organizations. Many of the writers and developers of these approaches have known each other, communicated with each other, and collaborated in a variety of informal or formal ways; others have proceeded more independently. In the literature of psychology, sociology, education, or training and organizational development, the common phrase, *creative problem solving*, has been used to describe many models, which may or may not have any common origins or structure.

Our approach to CPS ("upper case") has its origins in the seminal work of Osborn (1952; 1953). Many versions of his original work have been developed, based on continuous research and development (Isaksen & Treffinger, 2004; Treffinger & Isaksen, 2005). Although Osborn is best remembered for his introduction of brainstorming (Isaksen & Gaulin, 2005), he was also the first to detail a description and framework for CPS. As a framework for a creative approach to problem solving, CPS is based on an increasingly clear conceptual foundation (Isaksen, 1995; Isaksen, Murdock, Firestien, & Treffinger, 1993a: Treffinger, Isaksen, & Firestien, 1983) and a well-documented body of evidence of impact (Isaksen & De Schryver, 2000; Parnes, 1987; Puccio, Firestien, Coyle & Masucci, 2006; Reese, Treffinger, Parnes, & Kaltsounis, 1976; Rose & Lin, 1984; Torrance, 1987).

Isaksen, Dorval, and Treffinger (2000) introduced extensive changes in the language of the CPS framework that continue to be reflected in current work (e.g., Treffinger, Isaksen, & Stead-Dorval, 2006). The current model includes four components and eight different stages, portrayed in a circular rather than linear fashion, reflecting the reality that problem solvers enter and exit the process based on their own level of readiness and understanding of the problem situation. Fig. 1 presents the current graphic representation of our model.

The *Understanding the Challenge* component includes a systematic effort to define, construct, or focus your problem-

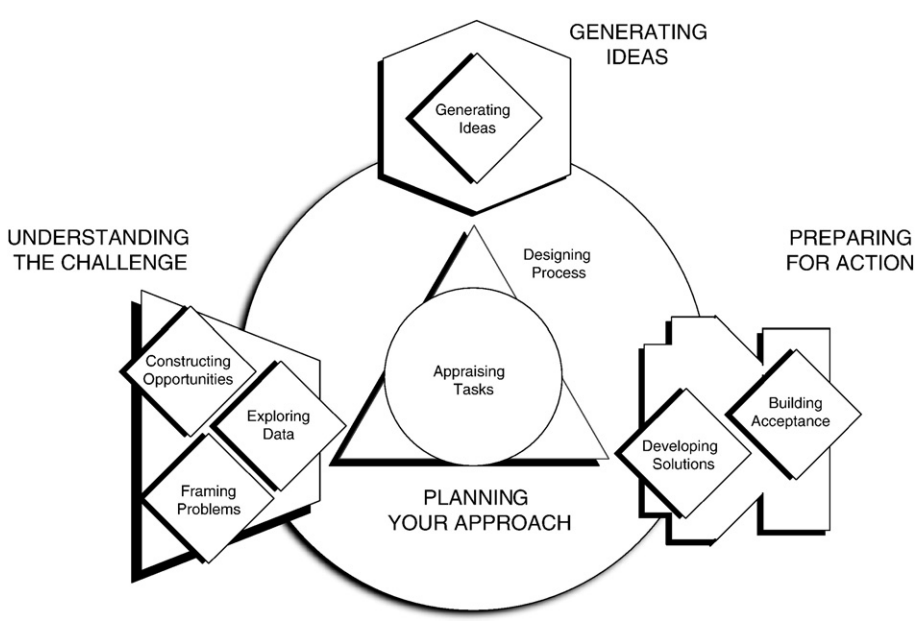

Fig. 1. The creative problem solving version 6.1™ framework © 2000. Creative Problem Solving Group and Center for Creative Learning; reproduced by permission.

solving efforts. It includes the three stages of Constructing Opportunities, Exploring Data, and Framing Problems. Constructing Opportunities involves generating broad, brief, and beneficial statements that help set the principal direction for problem-solving efforts. Exploring Data includes generating and answering questions that bring out key information, feelings, observations, impressions and questions about the task. These help problem solvers develop an understanding of the current situation. Framing Problems involves seeking a specific or targeted question (problem statement) on which to focus subsequent efforts.

The *Generating Ideas* component and stage includes coming up with many, varied, or unusual options for responding to a problem. During the generating phase of this stage, problem solvers produce many options (fluent thinking), a variety of possible options (flexible thinking), novel or unusual options (original thinking), or a number of detailed or refined options (elaborative thinking). The focusing phase provides an opportunity to examine, review, cluster, and select promising ideas. Although this stage includes a focusing phase, its primary emphasis rests in generating or the commitment of extended effort to seek creative possibilities.

Problem solvers use the *Preparing for Action* component to make decisions about, develop, or strengthen promising alternatives, and to plan for their successful implementation. This component includes two stages, Developing Solutions and Building Acceptance. Developing Solutions involves analyzing, refining, or developing promising options. If there are many options the emphasis may be on compressing or condensing them so that they are more manageable. If there are only a few promising options, the challenge may be to refine, strengthen, or develop each one to make it as strong as possible. This stage can involve ranking or prioritizing a number of possible options, generating and selecting specific criteria for evaluating promising options or selecting the most promising options from a larger pool. The emphasis in this stage is primarily on focusing options and developing promising ideas into plausible solutions.

The Building Acceptance stage involves searching for potential sources of assistance and resistance and identifying possible factors that may influence successful implementation of solutions. The aim is to help prepare solutions for improved acceptance and greater value. This stage helps the problem solver identify ways to make the best possible use of assisters and avoid or overcome possible sources of resistance. By considering these factors, problem solvers can develop and evaluate a plan of action. Preparing for implementation also provides opportunities to consider alternative possibilities, contingency plans, or feedback loops.

Isaksen, Dorval, & Treffinger (2000) also introduced the *Planning Your Approach* component (including the Appraising Tasks and Designing Process stages) as an integrated component, at the center of the CPS framework (graphically and in practice). Planning Your Approach functions as a "management" component, guiding problem solvers in analyzing and selecting "process" components and stages deliberately. A technology metaphor may be helpful in understanding the differentiation between process and management components. Consider the process components as "applications in a suite of software" (such as the applications within Microsoft Office, for example), and the management component as the operating system of the computer (always "on," but in the foreground of your attention only when needed).

CPS Version 6.1™ expanded the emphasis on CPS as a system — a broadly applicable framework for process that provides an organizing system that incorporates *productive thinking tools* for generating and focusing options (e.g., Isaksen, Dorval, & Treffinger, 1998; Treffinger & Nassab, 1998, 2000), the CPS process components and stages, as well as the CPS management component. These elements of the total system relate to managing the interaction between method (the CPS Framework) and content (the task or desired outcome) by allowing for the design of appropriate and customized strategies for integrating tools, language, and process approach to respond to a specific need.

A systemic approach also enables us to consider more explicitly and effectively the interactions or linkages among characteristics of people and the environment or climate within which they solve problems creatively (Isaksen & Tidd, 2006). This has led, for example, to the development of a measure of the context that includes both quantitative and qualitative assessment approaches (Isaksen & Ekvall, 2006), and to the development of a model and diagnostic tool to help identify personal style characteristics that are relevant to problem solving behaviors, which is the specific focus of this paper. These new research-based initiatives provide for integration of salient personal characteristics and situational conditions in designing appropriate "pathways" for learning and applying CPS.

Another major thrust within the 50 years of research and development of CPS was the investigation of the relationships between characteristics of the person and the CPS framework itself. Although early efforts in an academic setting to develop CPS skills and abilities deliberately were very successful for the experimental subjects who remained for an entire four-semester program, some subjects did not complete the entire sequence. The experimental and control subjects who continued in the program were initially comparable on nearly all the personality assessments conducted. There were some interesting findings, however, regarding those experimental and control group members who dropped out. They possessed characteristics such as: more directed toward deviancy or culturally disapproved behavior, in closer contact with their primary processes, freer, more impulsive, more likely to drop out of college, less responsible and more anxious (Parnes, 1987). Dropouts seemed to be more interested in artistic forms of creativity and withdrew because of their disappointment in the nature of the course. The implications and more extensive description of the findings of the dropouts are reported extensively in Parnes & Noller (1973) and Parnes (1987). This link to individual differences formed the basis for the Cognitive Styles Project, the purpose of which was to strengthen our understanding of the individual differences associated with learning and applying CPS. More than 30 master's theses, doctoral dissertations, and scholarly publications have been produced through the course of the project in academic settings and in other organizations,

involving a variety of investigators (e.g., Isaksen, 2004; Isaksen & Treffinger, 2004; Puccio, Wheeler & Cassandro, 2004). Our model of problem-solving style and our related assessment instrument are central to our ongoing efforts to understand how individuals personalize their efforts to learn CPS and to apply it, both individually and in groups.

3. Unraveling level and style of creativity

Although the literature on creativity has long and often embraced a multi-factored approach to understanding creative abilities, motivations, skills, and characteristics (e.g., Feldhusen & Goh, 1995; Isaksen, Murdock, Firestien, & Treffinger, 1993a; Lubart, 2000–2001; Reiter-Palmon & Illies, 2004; Rhodes, 1961), many researchers have inextricably linked high-level creative performance with one creativity style. Indeed, several writers contended that a great deal of creativity research confounded or "muddled" the dimensions of *level* and *style* of creativity (e.g., Isaksen & Dorval, 1993; Isaksen, Dorval, & Kaufmann, 1992; Isaksen & Puccio, 1988; Teft, 1990) and called for increased attention to the role of style in creativity research (e.g., Feldhusen & Goh, 1995; Sternberg & Grigorenko, 1997).

Essentially, this issue involves making a distinction between a focus on capacity, competence, or the extent or degree of one's creative ability, (*level*, expressed informally in the question, "How creative are you?") and a focus on mode or preference for certain ways of expressing or applying creativity (*style.* expressed informally in the question, "How are you creative?"). Kirton (1994) made the sharpest conceptual distinction between level and style and suggested the analogy that level refers to the power of the engine, and style refers to how one drives the car. Consistent with a view of creativity as multi-dimensional, we propose that both level and style are among the factors that influence creative behavior (as illustrated in Fig. 2).

4. Problem-solving style

We define problem-solving styles as consistent individual differences in the ways people prefer to plan and carry out generating and focusing activities, in order to gain clarity, produce ideas, and prepare for action. An individual's natural disposition towards change management and problem solving is

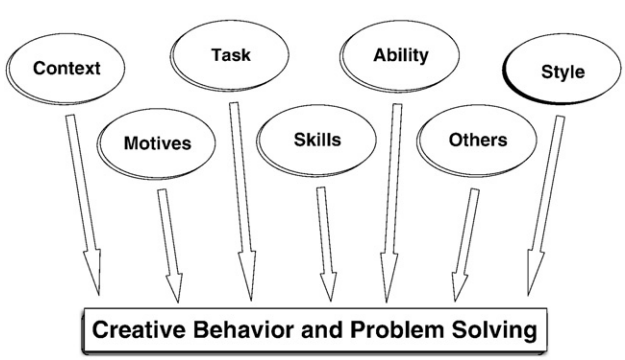

Fig. 2. Influences on creative behavior and problem solving.

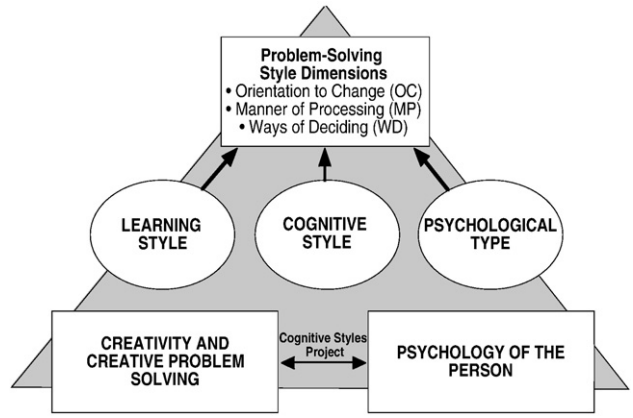

Fig. 3. Foundations of problem-solving style (Treffinger, Selby, Isaksen, & Crumel, 2007; reproduced by permission).

influenced in part by mindset, willingness to engage in and respond to a situation as presented, and the attitudinal dimensions of one's personality.

The theoretical foundations of our conception of problem-solving style represent an integration of psychological type theory (e.g., Myers & McCaulley, 1985), learning style theory (Dunn & Dunn, 1992, 1993) and cognitive style theory (Kirton 1976; Martinsen & Kaufmann, 1999) with theory, research and field experience centered on creativity, creative productivity, and creative problem solving instruction and training (e.g., Guilford, 1986; Isaksen, 1987; Schoonover, 1996; Selby, 1997; Sternberg & Lubart, 1995). Our experience in the field, working with assessment approaches based on these theoretical understandings, lead us to conclude that often the breadth or scope of both the theory and the assessments was difficult to align with CPS in its current form. For example, while there appears to be broad agreement that no single style is socially valued more or less than any other, and that no style preference is universally more (or less) creative than any others, the language used in some approaches seemed to carry a negative social connotation for some style preferences; by contrast, we found that all styles play a valuable and constructive, albeit different, role in applying CPS. In addition, the relevance of certain style constructs in various measures (e.g., external or internal processing) were more relevant and important in CPS than others (e.g., preferred time of day for learning). It became clear that different terminology, constructs focused on preferences related directly to CPS, and an alternative assessment approach would enhance our understanding of problem-solving style and its links to the creative problem solving process.

Further, through our work on linking person and process (e.g., Isaksen, Dorval & Treffinger, 2000; Treffinger, Isaksen, & Stead-Dorval, 2006), we realized that a synthesis of major theoretical approaches would yield valuable insights into problem-solving style. We also recognized that, in order to obtain a clear picture of style that would be relevant to the preferences of individuals or groups during problem solving, we needed to frame our model and assessment around three dimensions (Isaksen, Lauer, & Wilson, 2003; Selby, Treffinger, & Isaksen, 2007a). The diagram in Fig. 3 illustrates how our

work in understanding creativity and creative problem solving, linked to basic theory on the psychology of the person through the Cognitive Styles Project, supported by an in-depth investigation of learning and cognitive styles and psychological type, resulted in the three-dimensional structure of our problem-solving style model.

5. The three dimensions of problem-solving style

Our problem-solving style model (Selby, Treffinger, Isaksen & Lauer, 2004; Treffinger, Selby, Isaksen, & Crumel, 2007) and the accompanying assessment instrument (Selby, Treffinger, & Isaksen, 2007a,b) involve three independent dimensions, which are: Orientation to Change (OC), with two general styles: the Explorer and the Developer; Manner of Processing (MP), with two styles: External and Internal; and, Ways of Deciding (WD), in which we define two styles: Person-focused and Task-focused. Each dimension influences directly the ways people perceive problems and information, process data, generate possible solutions, make choices and decisions, and prepare to implement solutions. They also provide information that individuals can use constructively to solve problems and manage change more effectively. As in all discussions of type and style, most people share some preferences associated with each style. Individuals emphasize these style preferences through their typical behavior across varying contexts and over sustained periods of time. An individual's preference for any style may be moderate or well-defined, which can influence his or her behavior in finding, defining, and solving problems (although the extent to which less clearly defined preferences play a moderating role in a group is also influenced by the specific "mix" of style preferences among the group's members; a "moderate" preference may appear to be extreme if it is distant from the preferences of others in the group).

We chose the three dimensions based on previous experience with a variety of style measures and models and our experience in the field with observed differences among individuals and within groups during creative problem-solving sessions. These dimensions influence directly the ways in which people perceive, process, and make choices during CPS; they involve preferences that are readily observable and able to be managed effectively within groups.

5.1. Orientation to change: Explorer–Developer

The two styles in the Orientation to Change dimension (Explorer and Developer) represent cognitive aspects of problem-solving style, and address the questions: "How do I prefer to deal with boundaries and parameters?", "How do I feel about and react to structure?", and "How do I prefer to respond to novel challenges?"

5.1.1. The Explorer style

In ordinary use, an "explorer" thrives on venturing in uncharted directions, seeks to break new ground, and follow adventurous or promising new possibilities wherever they may lead. Explorers enjoy initiating a broad range of tasks, and thrive on new, ill-defined, and ambiguous situations and challenges. Explorers seek to create many unusual and original options that, if developed and refined, might provide the foundation for productive new directions. They enjoy seeing unusual possibilities, patterns, and relationships. Other people may find their highly novel ideas difficult to understand or initially to "buy into." Explorers tend to embrace new experience and to "plunge" right into novel situations. They do not fear (and may seem to thrive upon) risk and uncertainty, and often improvise as the situation unfolds, becoming so involved in the excitement of new ideas that concerns about efficiency and practicality may be forgotten.

When understanding the challenge in CPS, Explorers often emphasize new directions and frame the problem in original ways. They generate a large amount of data and many possible problem statements. They have a tendency to focus too much on the desired future instead of the current realities. Explorers may need help in moving from generating to focusing activities, and may continue to generate and consider new ideas about a project, even after closure has been reached, or they may abandon a project before reaching any closure, so they can pursue new challenges. They often find plans, procedures, and structures that are imposed on them to be confining and limiting. As they plan for action, Explorers may miss vital details or fail to give high priority to deadlines, while leading the way to action and providing flexibility in the face of the unexpected.

5.1.2. The Developer style

In ordinary use, a "developer" brings tasks to fulfillment, starting with the basic elements or ingredients and then organizing, synthesizing, refining and enhancing them, forming or shaping them into a more complete, functional, useful condition or outcome. Developers are concerned with practical applications and the reality of the task. They use their creative and critical thinking in ways that are recognized by others as being helpful and valuable. They prefer problems and solutions within the framework of present experience, seeking change that is incremental, practical, and easily assimilated by the current reality.

As they try to understand the challenge in CPS, Developers emphasize improvement and realistic ways of framing the problem. They are often economical and precise when exploring data, but they tend to focus on their understanding of the current reality instead of desired outcomes. Developers prefer finding a small number of workable possibilities and guiding them to successful implementation. They tend to focus on bringing one task to closure before taking on a new challenge. Their action plans are often detailed and clearly define areas of assistance and resistance that can be expected as the plan is executed. They may need help in maintaining flexibility in the face of the unexpected.

5.2. Manner of Processing: External–Internal

The second dimension of problem-solving style involves one's preferred Manner of Processing (MP) information during

problem solving, through either an External or Internal style preference. This dimension addresses the questions: "How do I prefer to manage information and its flow when problem solving?" "When do I share my thinking?" and "Does interacting with others build or spend energy?" Manner of Processing is related to the construct of extraversion–introversion in other measures, although rather than characterizing the respondent as a certain kind or type of personality, we focus specifically on the individual's behavioral preferences when solving problems or managing change.

5.2.1. The External style

Individuals who exhibit a well-developed preference for the External style draw their energy from interaction with others, discussing possibilities, and building from the ideas of others. They prefer physical engagement with the environment. When learning new and difficult material Externals clarify their ideas and understandings through discussion. They find the input of authorities helpful as part of their active discussion. They are not bothered by noise when studying, approach learning in several ways, and often find that physical mobility enhances their learning, thinking, and problem solving. Externals tend to be seen as good team members and often appear full of energy.

When solving problems, Externals test their view of the challenge against that of others and seek a great deal of input from others before reaching closure. When generating ideas they tend toward activities that involve an active lively exchange, but they may also dominate idea generation sessions. Preferring action to reflection, they may appear to rush into things before working out a thorough, detailed plan of action and before others are ready to proceed.

5.2.2. The Internal style

Those with a well-developed Internal style look first reflectively to their own inner resources and draw energy from their reflection. They tend to become engrossed in inner events, ideas, and concepts. Internals prefer learning privately, working at least initially without the help of peers or authority figures. They may seem quiet and might be perceived by others as pensive or withdrawn. Internals emphasize quiet reflection and processing information at their own pace.

Internal problem solvers prefer to consider ideas and come to an understanding of the challenge and surrounding data on their own before sharing their thinking with others. Their analysis of the situation and data is often careful and thoughtful. Fast-paced idea generation sessions may leave Internals feeling left behind. They benefit from being able to reflect on the challenge and possible solutions before the generating session begins. They embark on action only after giving it careful consideration.

5.3. Ways of Deciding: Person–Task

The third problem-solving style dimension involves preferences for Ways of Deciding (WD) about options or possibilities. This dimension addresses such questions as: "What factors get first priority when I focus or decide?" "Where do I start?" and "How do I make trade-offs?" The two styles in this dimension, Person and Task, focus on one's primary focus when making decisions. Ways of Deciding is related to similar constructs in other measures, such as Thinking — Feeling in the MBTI® (Myers & McCaulley, 1985). As for Manner of Processing, however, we focus on the behavioral preferences in solving problems or managing change rather than identifying a general personality type.

5.3.1. The Person style

Individuals with this style preference consider first the impact of choices and decisions on people's feelings and support, and on the need for harmony and positive relationships. They prefer to be emotionally involved when setting priorities. They are often seen as warm, friendly and caring. They often become quickly aware of, and respond to, the needs of others.

Individuals with the Person style look at challenges, data, and possible solutions in terms of personal impact. When generating ideas they try to ensure that all are heard and all ideas are respected. They seek solutions or decisions that all concerned can "buy into." In preparing for action, they may not identify possible limitations, in order to avoid offending others. However, they do tend to bring the human element and relationships to the forefront when planning their approach.

5.3.2. The Task style

Individuals with this style preference tend to look first at choices and decisions that are logical, sensible and can be justified objectively. They prefer making judgments that are impersonal, based on well-reasoned conclusions. Individuals with a Task style of decision making seek mastery of content or information to help them arrive at the "best solution" or response, or at a solution they can readily defend or justify. They may stress the need for staying cool and free from emotion, while seeking clarity, precision, and logical order.

Individuals with a Task style tend to take a well-reasoned, impersonal approach to challenges and data analysis. When generating ideas they may find it difficult to defer judgment, but often offer strong leadership in identifying the most promising and realistic options. They develop clear plans of action, with an emphasis on cause and effect. While they need to guard against overlooking the human element in the identification of sources of assistance and resistance, they bring needed attention to the "bottom-line" and ensure that the desired outcomes are clear.

6. Assessing problem-solving style

Our model of problem-solving style can be operationally defined through the assessment instrument, *VIEW: An Assessment of Problem Solving Style* (Selby, Treffinger, & Isaksen, 2007a). This 34-item instrument assesses the three dimensions and six styles in our problem-solving style model. Selby, Treffinger, and Isaksen (2007a) and Selby, Treffinger, Isaksen, and Lauer (2004) provided detailed information concerning the development of the instrument, its validity, and its reliability, based on our early research and development (N=3676). Table 1 presents the mean, standard deviation, range, and standard error of measure for each of the three dimensions of the VIEW

Table 1
Mean, standard deviation, Cronbach alpha, and standard error of measure for each of VIEW's three dimensions (N=10,151)

Dimension	M	SD	Range		Alpha	SEM
			Min.	Max.		
Orientation to change (Explorer–Developer)	74.6	15.8	18	126	0.87	5.68
Manner of processing (External–Internal)	30.1	9.2	8	56	0.82	3.89
Ways of deciding (Person–Task)	34.6	8.5	8	56	0.84	3.40

Adapted from Selby, Treffinger, & Isaksen (2007a), p. 39.

instrument, based on a more extensive data set involving more than 10,000 subjects from ages 11–82 in several countries. For the OC dimension, lower scores indicate a preference for the Explorer style, and higher scores for the Developer style. The scores for this scale ranged from 18 to 126, which was maximum possible range for the scale. The observed mean for the OC dimension was 74.6 and the standard deviation (SD) was 15.6. The reliability of .87 for this scale (Cronbach's alpha), and the standard error of the measure (SEM) was 5.68.

For the MP dimension, lower scores indicate an External processing style, and higher scores an Internal processing style. The responses on the MP dimension dispersed across the entire range of the scale, from 8 to 56. The observed mean was 30.1 and the SD for this scale was 9.2. Cronbach's alpha reliability for this dimension was 0.82, and the SEM was 3.89. Finally, for the WD dimension, lower scores indicate a Person style and higher scores a Task style. Again, observed scores represented the entire range possible, from 8 to 56. The mean of the WD dimension scores was 34.6, and the SD was 8.5. The reliability coefficient for this dimension was 0.84, and the SEM was 3.40.

Intercorrelations among scores on the three dimensions are all negligible, ranging from 0.08 to 0.10. There are also very low correlations between the dimensions and age (−0.11, 0.03, and −0.04, for OC, MP, and WD respectively). Scores are generally uncorrelated with gender for the OC (0.14) and MP (0.06) dimensions, and only minimally for the WD dimension (−0.31); this suggests a slight tendency for women to prefer the Person style and men to prefer the Task style, a finding parallel to that for other similar scales. (Given the large sample sizes, of course, small correlations of numerical value are statistically significant, even though the magnitude of the interrelationship is very low.) Selby, Treffinger, and Isaksen (2007a) presented evidence supporting the psychometric adequacy of the VIEW instrument in relation to both validity and reliability, including factor analytic studies indicating that the VIEW instrument assesses three independent factors or dimensions.

7. Creative problem solving, problem-solving style, and their interactions: implications for practice and research

Advances in our understanding of the Creative Problem Solving framework, problem-solving style, and their interactions hold great promise for future practice and research, and especially for those concerned with understanding and enhancing creative human behavior and organizational innovation (e.g., Isaksen, 2004; Isaksen & Dorval, 1993; Talbot, 1997) or with talent development and differentiating instruction (e.g., Selby & Treffinger, 2003; Treffinger, Nassab, & Selby, in press). These implications include:

1. Clarifying the constructs of creativity, style, and CPS

The emerging area of research on style (and the level–style distinction) actually has more to do with our fundamental assumptions and definitions of creativity than just rethinking our approach to psychological assessment. A major benefit of this distinction is a clarification of a more inclusive concept of level of creativity (Ripple, 1989). This is a major conceptual advancement for the field of creativity because much of the research conflates level with style (i.e. artists and those with "recognized flare" are creative, engineers who work quietly and steadily are not). Conflating level with style results in many confounding research findings and a dangerous bias in practical application (failing to distinguish style preferences from aptitude or ability, or proposing that certain preferences indicate higher or lower levels of creativity).

Some hold the position that creativity is novelty, originality of thought and action, and is more related to the generation of ideas. Others assert that creativity includes these constructs, but also includes usefulness, value, and acceptance of this novelty. These assumptions shape our thinking regarding who and what we place at the highest level of creativity. The former group will include a focus on those who have more iconoclastic ideas and outcomes, and may ultimately devalue those who focus on the useful aspects of novelty and bringing value to the original. Some solve this problem by contrasting creativity (the generation of new ideas) with innovation (meaning the commercialization of new ideas). Others argue for a more inclusive definition of creativity to include both the generating and focusing of new ideas, and one that embraces both radical and incremental approaches and outcomes.

Making the distinction between level and style can also clarify the concept of creativity style. An important question for those concerned with cognitive style, psychological type, and learning style is "Which of these approaches, and concomitant measures, offers the best explanation of the broad, yet stable, consistent, and more pure, concept of creativity style?" A recent study comparing two well-known creativity style measures conducted by Houtz, Selby, Esquivel, Okoye, Peters, and Treffinger (2003) certainly moves us in this direction, pointing out specific ways that various measures may assess different kinds of preferences, and may hold differing implications for effective instructional design and response. It is important, then, not only to distinguish between style (preference) and level (ability), but also to be aware of the specific preferences associated with a model and measure of style.

Since our work on a model of problem-solving style, and the VIEW instrument derived from that model, draws widely from the literature on learning and cognitive style, psychological type, and Creative Problem Solving, many new research opportunities have also emerged. These include, for example, correlational studies with instruments representing the theories

that formed the foundation for VIEW's development and additional validation research (including longitudinal and developmental studies). In addition, data useful to practitioners could be provided through studies as to the efficacy of VIEW in enhancing creative productivity for both teams and individuals at various ages and settings. VIEW also has implications for people who are working in, studying, or facilitating problem solving or change management with groups. It offers practitioners a common language or vocabulary for people to use constructively to understand and appreciate style similarities and differences among group members with whom they are working.

Thus, our understanding of the nature and definition of creativity, problem solving, and style benefit from increasing conceptual clarity that arises from ongoing research, development, and practical experience with CPS and problem-solving style assessment.

2. New directions and challenges regarding "teaching for creativity"

Evidence supporting an affirmative response to the question of "teaching for creativity" and the general effectiveness of instruction in CPS has long been available (e.g., Cramond, Martin, & Shaw, 1990; Isaksen & De Schryver, 2000; Isaksen, Murdock, Firestien, & Treffinger, 1993b; Kabanoff & Bottger, 1991; Mansfield, Busse, & Krepelka,1978; Rose & Lin, 1984; Schack, 1993; Stein, 1974, 1975; Torrance, 1972, 1987; Treffinger, 2002), although ongoing efforts continue to bring that conclusion to new audiences (e.g., Grigorenko, 2007). Advances in framing and applying Creative Problem Solving and in understanding problem-solving style, and their interactions lead us to a new, and arguably more powerful, question: "what works best, for whom, and under what conditions?" (e.g., Isaksen, 1987, 2002; Treffinger, 1993).

Reexamining traditional "step-stage" approaches to teaching CPS has also led to a number of implications for instruction. As CPS has moved towards becoming a more natural and flexible framework, offering individuals and groups greater choice and control over how to proceed as problem solvers, we have begun to reexamine the traditional view CPS as a linear set of steps and stages for students to learn and apply when solving problems. Current views of the CPS framework lead us to call into question the prescriptive, step-by-step lockstep for problem solving (or for scientific method or research and inquiry skills) that has been commonplace from elementary school to graduate school. Experienced problem solvers, like their academic research colleagues, have long questioned simplistic summaries of *the* [fixed, prescribed] steps for problem solving. A contemporary approach to CPS recognizes that an effective process framework must be flexible and dynamic.

While initial instruction in CPS may be more linear and sequential in nature, especially with children at the elementary school level, for example, we should also accept the challenge to guide students in more natural, flexible, and dynamic ways of applying CPS (Treffinger et al., 2006). Certainly, students from the upper elementary level upward can learn to examine a complex, open-ended problem or challenge carefully, to assess the relevance and potential value of applying any of the CPS components, stages, or tools, and then to proceed accordingly. They can also learn to monitor the effectiveness of their decisions and plans, and to adjust their process choices and strategies as they continue to work toward a solution.

Advances in the development of the CPS framework as a systemic approach also has implications for issues regarding the domain-specificity or generality of problem-solving methods and tools. Creative thinking, critical thinking, and problem solving are important and occur in many disciplines. The CPS system includes a variety of tools, strategies (guidelines for selecting and applying CPS), and techniques (personalizing tools and strategies based on style and other considerations) that can be applied successfully across a variety of domains. These practical but powerful tools augment tools that may be discipline-specific, given the varied nature of the problems and challenges to be addressed across domains or content areas.

3. Personalizing process instruction and applications

The CPS framework builds on a long tradition that emphasizes the cognitive, rational, and semantic dimensions of creativity (Treffinger, 1996). For nearly two decades, however, we have focused our research and development efforts on extending and enhancing the effectiveness and power of CPS by recognizing and incorporating the importance of personal characteristics, styles, and context in effective CPS applications. The question of "what works best, for whom, and under what conditions" led us to examine the nature and role of profiling for CPS (e.g., Isaksen, Puccio, & Treffinger, 1993) and to study the interactions of person and process in new ways. These efforts are consistent with other researchers' work to study individual differences in creativity and to highlight the importance of an interactionist perspective (e.g., Woodman, Sawyer, & Griffin, 1993; Woodman & Schoenfelt, 1989, 1990). We have learned that problem-solving style and the context or climate for creativity are important factors to consider in effective instruction in CPS (Isaksen, Dorval, & Treffinger, 2000; Treffinger, 1993; Treffinger, Selby, Isaksen, & Crumel, 2007).

Houtz and Selby (2007) assessed the problem-solving style of 42 graduate students using VIEW and compared those scores to the results of Torrance's (1974) *Thinking Creatively with Pictures* measure. They found no significant relationship between level (how creative you are) and style (how you are creative). They did find that on the OC dimension, Explorers, and on the WD dimension, the Person-oriented, had a significantly higher resistance to premature closure.

In another recent exploratory study, Isaksen and Geuens (2007) compared the VIEW scores of 81 respondents to their preferences for learning and using problem-solving tools, guidelines, stages and components following training sessions in CPS. They found significant relationships between scores on the three dimensions of VIEW and preferences for various aspects of CPS, including use of generating and focusing tools. Explorers reported significantly higher use of all four of the generating guidelines than Developers. They also indicated higher levels of both use and enjoyment of the generating tool known as "Brainstorming with

Table 2
Differentiated instructional needs among students with various problem-solving style preferences (Selby & Treffinger, 2006)

Students with an explorer style need
• Freedom to be spontaneous, to go in unusual or unexpected directions, to enter a task at any point
• Open-ended projects, novelty, permission to take risks and deal with several projects at once
• Recognition for the unique contributions and how their work breaks new ground
Students with a developer style need
• Structure, to know how new material fits into what they know, to proceed on one thing at a time, in a well-organized manner
• To understand the value of what they are doing in terms of the big picture
• Recognition for how their work improved over time
Students with an external style need
• Opportunities to engage the environment, explore ideas, and gain clarity through discussion
• Projects involving others, outward events, and engaging requirements
• Permission to be actively involved as soon as possible and to check on the progress of others
Students with an internal style need
• Opportunities for quiet reflection, to consider ideas apart from others
• Projects they pursue alone, tied to their personal interests, with time to polish their presentations
• Permission to listen to other's thoughts about a project and to take ample time for preparation before acting
Students with a person-oriented style need
• To develop rapport with peers, and to understand the benefits or value of their work for others
• Projects with a human angle, involving collaboration in a supportive climate, checking often to verify that others are comfortable with the course of action
• Feedback indicating appreciation for them as a person and their contributions to the group
Students with a task-oriented style need
• To explore cause and effect relationships with problems requiring in-depth analysis
• Logical, sequential instruction, projects designed to bring order out of confusion
• Feedback that their approach provided valuable levels of clarity and precision

Post-its®". Externals, enjoyed using the focusing guideline of "affirmative judgment," and also reported a higher level of enjoyment for the generating guideline that calls on one to "strive for quantity". Externals, as compared to those with an Internal Manner of Processing reported significantly more use of the "staying on course" focusing guideline. In terms of the WD dimension, those with a Task-orientation indicated more enjoyment for learning to seek combinations when generating and using the "staying on course" guideline when focusing. They also reported a higher level of enjoyment, as compared to those with a Person-orientation, of the Constructing Opportunities stage of CPS. Not surprisingly, the Task-oriented also reported more use of the Appraising Tasks component of CPS.

Treffinger (2006a) investigated the impact of an awareness of personal problem-solving style preferences on the problem-solving performance of middle and high school level teams involved in a problem-solving competition (the Future Problem Solving Program; FPSP). Teams in an experimental group received feedback based on individual VIEW scores, while the control groups received no training in problem-solving style. After the initial VIEW feedback, no additional experimental intervention occurred, and the coaches in both conditions (all experienced in the program) followed their customary procedures with their teams. The groups were then compared on written evaluations of their problem-solving performance, prepared by FPSP-designated evaluators, using the standard evaluation forms and procedures for the program, without knowledge of the teams' participation in the experiment. There was a significant difference ($F=5.78$, $p<0.02$) between the mean scores of the teams in the experimental ($x=77.4$) and control ($x=63.3$) conditions. Students on teams who responded to VIEW and received feedback performed better than control students on an independent evaluation of the problem-solving performance. Thus, Treffinger found that the impact of having learned about team member style preferences had practical value and importance in the initial success of the teams in the experimental group.

Improving our understanding of the level–style distinction can result in a more comprehensive and less contradictory understanding of creativity characteristics, and a better ability to target aspects of the creative process for improved learning and application of tools and methods. This distinction can add another dimension in understanding creative productivity and outcomes as well as the different situations that may be more conducive for different preferences.

Differentiation of instruction, a topic of significant interest in education today (e.g., Tomlinson, 2001, 2004; Treffinger, Young, Nassab, Selby, & Wittig, in press), involves a process of instructional planning, design, and action that ensures appropriate, challenging, and developmental learning experiences for each learner, and problem-solving style can serve as an important and useful variable to consider in that process. Viewing differentiation as a process of recognizing and responding to differences and the uniqueness of learners enables educators or trainers to help individuals and groups "personalize" or customize their learning. Table 2 illustrates differences in instructional needs among students with various problem-solving style preferences (Selby & Treffinger, 2006).

4. Recognition and nurture of personal strengths and talents

The results yielded by the VIEW assessment can help individuals recognize, describe, and appreciate their own problem-solving style preferences. These data can be used to guide individuals in formulating their own creative strengths profiles, and to develop and apply their personal talents as fully as possible. Individuals can use their scores to test their reported or perceived preferences against their typical behavior or performance on a daily basis in varied situations, in order to affirm or modify an understanding of their strengths or weaknesses in terms of problem-solving style. Their VIEW results can help them to grow in understanding of their unique style preferences. With this knowledge, individuals can identify ways to be at their personal best, and they can determine how, or under what conditions, they may benefit from the strengths of others.

In addition, a contemporary, flexible approach to CPS provides individuals with an extensive "toolbox" upon which they can draw to enhance their creative productivity and effectiveness across a

wide range of tasks and situations. We believe that a promising direction for research on creativity, as well as for gifted education or talent development, will involve investigating the extent to which knowledge of personal style and competence in knowing and using CPS tools will help individuals to perform at high levels, transcending the presumed limitations of categorical designations of aptitude or giftedness. The possibility that we can teach for "gifted" or expert performance, rather than simply selecting "gifted people" may be a challenging, but highly significant direction for educational practice.

5. Strengthening collaboration and teamwork dynamics

Advances in CPS and problem-solving style assessment also have implications for effective teamwork and group collaboration.

Providing an expanded and flexible set of tools for generating options as well as for effective decision making offers valuable support for many essential tasks of teams, whether in a small group learning project in an elementary school classroom, a creativity program for teams of adolescents (such as Future Problem Solving or Destination ImagiNation®; see, for example, Treffinger, 2006a or Treffinger & Purifico, 2004), or in high-level teams and work groups in large corporations (see, for example, Isaksen & Tidd, 2006).

The ease of administration and scoring of the VIEW instrument makes it an appropriate tool for use with young people and adults who wish to understand their own approach to change and problem solving. As such it has applicability in an effective team-building experience for adult leadership and management groups. As part of a training program, the data provided by VIEW can be very useful in helping teams and individuals develop more effective problem solving and change management strategies. When feedback is offered to students in school settings, the data provided by VIEW can be useful in helping teachers in creativity instruction, and in developing Creative Problem Solving teams. Selby and Treffinger (2006; see also Treffinger, 2006b) reported that an understanding of style might be helpful in the differentiation of instruction when working with problem solving groups. For instance, Developers prefer analytic tools and well-structured material while Explorers benefit from the freedom to modify problem solving tools to meet their own needs while going off in unusual directions, seeking novelty, and taking risks. Externals prefer projects, tools, and strategies that allow a high level of active engagement along with an early exchange of ideas. On the other hand Internals benefit from projects and tools that permit time for reflection and careful preparation before being called on to share with the group. Those with a Person-oriented Ways of Deciding style prefer to know how their efforts will help others; they work best with tools and strategies that involve relationships, whereas Task deciders need to get directly to the task and in-depth analysis.

With adults, VIEW can be a helpful tool for team building and leadership development efforts. VIEW can also be used to enhance and support organizational efforts addressing strategic change, guiding change and innovation, or other deliberate change management initiatives. Project management teams can use VIEW to enhance communication and build effective collaboration among team members. Working in corporate settings with various groups including teams from a large supermarket chain, a large insurance firm and a financial services firm, Esposito and Roehm (2004) found that feedback from VIEW helped individuals gain insights about their approach to creativity and problem solving. They reported that in each setting VIEW results enabled individuals to identify ways that they could be at their personal best while benefiting from the strengths of others in the group. Knowledge and awareness of styles supported the selection and use of the various methods and tools of creative problem solving, while improving communication and teamwork.

8. Conclusion

In summary, creativity research and theory and their application in real world settings are continually evolving. Part of that evolution has involved a more flexible understanding of the process involved in Creative Problem Solving. That evolution also involves an emerging understanding of the construct of problem-solving style and the influence that construct holds on creative productivity. *VIEW: An assessment of problem solving style* is a new instrument for assessing problem-solving style. It is the result of more than five years of research and development. Recent studies indicate that it is both reliable and valid for the assessment of an individual's style of problem solving and change management. It has applications for research and in settings where individuals would gain as a result of a better understanding of their problem-solving style.

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