Problem Solving Style and Creative Productivity

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Abstract

Freshmen education students created five-to ten-minute multimedia presentations in response to one of several prompts about education, learning, and teaching. Students who completed *VIEW: An Assessment of Problem Solving Style* were assigned to working teams based on their *VIEW* scores such that team members were similar on the three dimensions of problem solving style (Orientation to Change, Manner of Processing, and Ways of Deciding). Students' presentations were scored for clarity of prompts used, for supporting details, and for use of multi-media to enhance the presentations. Generally, on Orientation to Change, Developer-dominated teams received higher ratings on clarity of prompt expressed in their presentations. In addition, "style-matched" teams received higher ratings than randomly-created teams but this result had low statistical power, so results must be considered suggestive only. Additional research on problem-solving style and creative productivity is essential.

***Keywords*:** Problem solving style; creativity; orientation to change; manner of processing; ways of deciding.

Introduction

A major (if not primary) goal of instruction is to maximize learning and achievement. To that end, educators at all levels have searched for dependable and effective instructional methods based on theories and knowledge of human learning and behaviour. It is a truism to say that learning is a complex phenomenon depending on and influenced by many factors, but at least one hypothesis has received considerable attention from researchers, that if there is a better match between the instructional methods and learners' individual information processing preferences and strengths, the outcomes are better (Cronbach & Snow, 1977). This hypothesis remains of interest to researchers despite mixed results over the years if for no other reason than it seems such a natural idea, that behaviour is a function of the person and environment (or context) interacting together (Lewin, 1936, Woolfolk, 2010).

To examine the "person" side of the interaction, there have been numerous efforts over several decades to identify and to assess learners' information processing and responding styles and to relate styles of instructional strategies and methods (Jonassen & Grabowski,1993; Sternberg, 2000). Among the most recent efforts has been the assessment of creative problem- solving styles (Treffinger, Selby, & Isaksen, 2008; Treffinger, Selby, Isaksen, & Crumel, 2007). The importance of the idea of creative and problem-solving styles is that we no longer look solely at how much creativity a person exhibits. Instead, we are able to study "how" a person uses his or her creative skills. It is an idea referred to as the "level-style" distinction, and it assumes that individuals of different styles can still effectively solve problems (Isaksen & Dorval, 1993).

Recognizing the "level-style" distinction puts the emphasis back on the context of problem solving, the task conditions, demands, or constraints (or lack thereof) that problem solvers face. When Isaksen, Sternberg, and others (Isaksen, Dorval, & Treffinger, 2010; Sternberg & Lubart, 1995; Zhang & Sternberg, 2006) argue that most real-life problems are very complex and "fuzzy," it follows that certain personal styles of information processing may be more effective than others. For example, to

respond to complexity, individuals may need a wider range of cognitive processes indicative of a more open, flexible style. If the context is clearer, narrower, on the other hand, a better style "fit" might involve more judgment and evaluative processes (Treffinger, et al., 2007; Isaksen, Dorval, & Treffinger, 2010)

With a new instrument for assessing problem solving in individuals aged 12 through adult, entitled *VIEW: An Assessment of Problem Solving Style* (Selby, Treffinger, Isaksen, & Lauer, 2004), six problem-solving styles aligned over three dimensions have been identified that describe a person's consistent preferences for working on problems and for responding to change. The dimension termed Orientation to Change describes Explorers, who prefer to make their own way in approaching problems, and Developers, who prefer working within existing rules and structures. Developers may "push the boundaries," so to speak, but Explorers more likely ignore boundaries.

The second style dimension, Manner of Processing, describes External and Internal processors. Externals easily and early on share ideas with others and take strength from such interactions, whereas Internals require their own time and reflection before "joining the fray." The third dimension, Ways of Deciding, describes Person-oriented versus Task-oriented Deciders. When finally making decisions and settling on criteria for action, Person-oriented Deciders will consider the impact of their choices on people who might be affected. They will give weight to these implications, whereas Task-oriented Deciders will value more highly and make more decisions based on logic and efficiency.

To be sure, there are strengths and limitations of each of these six styles, but the point of the "level-style" distinction is that individuals characterized by each style still solve problems. They will respond to change, but their styles may or may not be most appropriate, most compatible, most complementary to the problem contexts they face. With respect to achievement, the educational psychology of style theory hypothesizes that "matches" of styles and situations will be most effective (Zhang, 2006a, 2006b, 2008).

The purpose of the present study was to test the relationship of style to achievement. First, if the "level-style" distinction is valid, different styles may make a difference in achievement depending upon the context and the task required. Second, "matches" may outperform "non-matches." Would students working on a substantive academic problem in a group format be better able to develop a better product if group members were similar to each other in one style or another? Would teams of "matched styles" create a better product than teams that were formed randomly? The present study was able to investigate these two questions and test the following hypothesis: group productivity will be higher if group members are "matched" in styles.

Method

Participants

Participants in the present study began with 464 freshmen undergraduates beginning their first semester at a mid-sized state university. These students had identified themselves as education/pre-service teaching majors, and represented approximately 33% of the entire incoming freshman class. There were 93 males and 374 females. They ranged in age from 18 to 26 years old. More than 85% of the students were Caucasian, with the remainder including individuals from a variety of ethnic backgrounds. The socioeconomic background of these freshmen may generally be characterized as middle- to lower-middle class.

From the total group, 401 students had taken VIEW on-line as instructed during the summer before attending the orientation in late August. Of these students, 67 teams were initially created with five or six members per team. On the day of the orientation, 63 additional students attended who had not taken VIEW. Of these students, 11 new teams were created with sizes of five-to six members. The freshman orientation preparation had planned for the possibility of non-VIEW students and assigned these students as they arrived randomly to new teams.

By the due date of the project, there were 65 teams that submitted a presentation. Of these, 56 were teams that were "matched" by their *VIEW* scores and nine teams that never took *VIEW* were thus considered "randomly-made." A limitation discussed below is that the nine "randomly-made" teams may have contained members with similar *VIEW* scores. Further, a number of teams, both "matched" and "randomly-made" lost members during the project period. Most teams retained six members. A few teams lost one or two members, but as many as two teams from the "randomly-made" group completed their projects with as few as three members.

Instruments

VIEW: An Assessment of Problem Solving Style. *VIEW: An Assessment of Problem Solving Style* is a relatively new measure of "…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" (Treffinger, Selby, Isaksen, & Crumel, 2007, p. 2). In each of its 34, seven-point Likert-type items, an individual is presented with two short descriptive phrases that represent different ends of a continuum. Each item belongs to one of three style dimensions. On the Orientation to Change dimension, the two styles assessed are termed Explorer and Developer. On the Manner of Processing dimension, the two styles are termed External and Internal Processors. On the Ways of Deciding dimension, the two styled are termed Person-oriented Deciders and Task-oriented Deciders.

To date, the reference sample of *VIEW* takers includes over 25,000 individuals, ranging in age from 12 to 80 years old. *VIEW* has been translated in seven foreign languages. Generally, all three scales yield reliability estimates over .80 (Schraw, 2007; Selby et al., 2004). Criterion and construct validity are equally positive, with correlations with other style measures and personality characteristics consistent with the definitions and descriptions of the *VIEW* styles (Houtz, Ponterotto, Burger, & Marino, 2010; Houtz, Matos, Scheinholtz, & Selby, 2007; Houtz & Selby, 2009; Shaw, Selby, & Houtz, 2009). In addition, factor analyses support the internal structure of the *VIEW* items and dimensions (Anthony, Rauch, & Williams, 2011; Schraw, 2007; Selby et al., 2004; Vasquez & Proestler, 2011).

A well-maintained website (www.viewassessment.com) offers free downloads of research articles about *VIEW* and updates of technical data, as well as additional information about style dimensions and how styles affect creative problem solving. *VIEW* is a controlled measure and individuals who wish to use *VIEW* in their research or work must receive training and abide by standards such as those endorsed by the American Psychological Association, the American Education Research Association, and other professional societies.

The Freshman Orientation Assignment and Procedures

During July of the Summer preceding their first semester, incoming freshman were mailed a letter and instructions to access the VIEW website and complete *VIEW: An Assessment of Problem Solving Style*. By the August orientation date, most freshmen had done so and their scores on the three dimensions were used to create more than 60 six-person teams matched to the extent possible on similar styles.

The orientation session late in August involved welcoming and introductions and seating assignments throughout the large auditorium based on which team a freshman belonged. During the two-hour orientation, students were shown three short video clips designed to motivate and to illustrate aspects of learning and thinking. The video clips included:

1. Dalton Sherman's "Believe in Yourself";
2. A scene from the movie "Dead Poets Society"; and
3. A most recent "Shift Happens" video.

These clips are available on the YouTube website. Dalton Sherman was a 10-year-old motivational speaker, exhorting individuals to have confidence in their own abilities to achieve. The clip is of a speech he gave before 20,000 teachers in Dallas Texas. The scene of the actor Robin Williams in "Dead Poets Society" illustrates his teaching philosophy and motivation for his students to "seize the day (*carpe diem*)." Finally, the "Shift Happens" video illustrates the rapid pace of change in human civilization and implications for education.

After seeing the three clips, the multi-media project was then described. Students were to work together in their respective teams to create a brief, five-to eight minute multi-media presentation that offered their views about students, teaching, and learning. Their presentation could respond to one of several prompts offered in the assignment materials. The five prompts were:

1. As a new college pre-service teacher, what do you believe about students, teaching, and learning?
2. What currently accepted beliefs/assumptions about students and practices of teaching and learning will need to change within the next 20 years?
3. What emerging national and economic, political, and social changes do you see that could impact schools? How do you foresee these events affecting your career?
4. In what ways do Mr. Keating's teaching methods reflect Dalton's beliefs about students? How would Dalton describe the teaching styles of Mr. Keating's colleagues?
5. Is "Shift Happens" an accurate perception of the teaching and learning landscape at the end of the first decade of the twenty-first century? Why or why not?

Materials given to students during the orientation also described resources in the university that students could access in support of their work. These included technical support from computer and media centres as well as in-person, on-going advice and feedback from a project consultant. Suggestions for how effective groups typically function, including the designation of a team leader and other activities of group work were also distributed as part of the orientation materials. Students had six weeks (by mid-October) to complete and submit their projects. For the most part, one team member submitted the final presentation via e-mail. A few submissions were on CD or DVD.

Results

Evaluation of the Presentations

A rubric for scoring each of the presentations was developed that included a rating scale for each of the three main components of students' presentations. The three components were:

a. The degree to which the presentation clearly reflected the prompt chosen by the team;
b. The degree to which the presentation included relevant information and details in support of the prompt; and
c. The degree to which the use of multi-media supported or enhanced the presentation. For each component, raters could award zero to three points.

Thus, a maximum score on a team's project could be nine points. Pearson intercorrelations among the judges' ratings were small, ranging from -.006 to .627, with an average of only .250 for the 36 possible correlations. An alternative procedure was therefore needed to establish a degree of reliability to warrant further analyses. It was decided to consider the nine ratings as individual items as if from a single measure of a specific phenomenon, in this case, the overall "value" of a team's presentation. Using the nine ratings in this manner, a Cronbach's Alpha estimate of reliability was computed to be .7198, a much more acceptable level to justify further analyses.

However, assuming the nine ratings to be individual items of some hypothetical scale of value did raise the issue of what is termed Common Method Variance (CMV; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), which is a potential scoring bias when multiple measures are taken of the same

phenomena. With the problem of CMV, subsequent ratings may be affected by previous ratings, either positively, as in a "Halo Effect", or negatively. To compensate for the possibility of CMV, a popular remedy is to factor analyze the individual ratings. If there is CMV bias, there will be a large first factor extracted. Any subsequent factors are considered free of such bias.

The nine ratings were subjected to a principal components analysis with varimax rotation. Two factors among the nine ratings were identified, accounting for approximately 53% of systematic variance. The first factor extracted was the three raters' scores on the second and third rubric criteria, supporting details and use of multimedia to enhance the presentation, with loadings ranging from .503 to .728, accounting for 31% of the total variance. The second factor extracted was the three raters' scores on clarity of prompt exhibited in teams' presentations, with loadings ranging from .734 to .830, accounting for another 22% of variance.

Based on this analysis, two composite scores were computed for testing the hypothesis of the effects of problem-solving style on productivity. For purposes of labelling, the two composite scores were termed Clarity (factor 2) and Work (factor 1). The Clarity score was the simple sum of the three scorers' three individual rubric ratings on clarity of prompt. The Work score was the simple sum of the three scorers' six rubric ratings of supporting details and use of multimedia.

Overall VIEW Results

Table 1 presents descriptive statistics for those students who completed *VIEW*. Skew and kurtosis computations revealed no deviations from normality. *VIEW* scores revealed that these students' Orientation to Change scores were a nearly one-half standard deviation higher than the hypothetical mean of 72 for *VIEW*. These results suggest a general characteristic of these participants as Developer. Results for Manner of Processing and Ways of Deciding did not deviate very much from the hypothetical mean of 32 for each of these scales. These freshmen scored slightly External and as People-oriented Deciders. These results are consistent with previous studies involving both pre- and in-service teachers (Houtz, et. al., 2007, 2009, 2010).

Table 1: Descriptive statistics for VIEW orientation to change, manner of processing, and ways of deciding (N = 401).

VIEW Dimension	M	*SD*	*SE*	Minimum	Maximum
Orientation to Change	80.768	15.159	.757	25	126
Manner of Processing	29.633	8.769	.438	10	56
Ways of Deciding	30.277	7.028	.451	8	50

Pearson correlations were computed among the *VIEW* scores. Orientation to Change correlated with Manner of Processing and Ways of Deciding (*r*'s = .157 and 279, respectively). Manner of Processing correlated with Ways of Deciding ($r = .271$). Each of these correlations was statistically significant ($p < .01$). Again, the international database of *VIEW* scores does not show significant correlations among the three *VIEW* scores. However, previous research with education students has observed small but significant correlations (Houtz et al., 2007, 2009, 2010).

Finally, analyses reported below, compare teams characterized in the main by each of the three *VIEW* score dimensions separately. Teams, of course, have all three scores together in their respective make-ups. According to *VIEW* theory, the combinations of the six styles across the three *VIEW* dimensions yields eight distinctive style-types (2 x 2 x 2 = 8).

Table 2 lists the frequency of each of the eight types observed among the original 67 teams and the 56 teams that submitted presentations. As can be seen, Developer-dominated teams far outnumbered Explorer-dominated teams. In this study, comparisons among the eight possible style types of teams were not possible due to the under-representation of all eight style types.

Table 2: Frequencies of the eight VIEW styles observed among the original 67 teams and final 56 teams that submitted presentations.

Style Type	Frequency	Percentage	Frequency	Percentage
Explorer External Person	9	13.4	5	8.9
Explorer External Task	2	3.0	2	3.6
Explorer Internal Person	3	4.5	3	5.4
Explorer Internal Task	2	3.0	1	1.8
Developer External Person	15	22.4	15	26.8
Developer External Task	11	16.4	8	14.3
Developer Internal Person	10	4.9	9	16.1
Developer Internal Task	15	22.4	13	23.2
Total N	67		56	

Comparisons of "Matched" and Randomly-Made" Teams

To test the hypothesis of this study, analyses of variance were computed comparing Clarity and Work scores across "matched" and "randomly" formed teams. Table 3 contains descriptive statistics for the 56 teams on the two composite scores Clarity and Work. On both Clarity and Work, mean ratings are larger for "matched" teams. However, there are no significant differences on Clarity (F = .997, df = 1,55). On Work (F = 3.17, df = 1, 55), the significance level is .08, with a power of .42.

Table 3: Descriptive statistics for style comparisons among teams.

	N	M	SD	SE
Orientation to Change				
Clarity				
Explorer	12	4.000	2.256	.651
Developer	44	5.454	1.438	.217
Work				
Explorer	12	9.083	3.579	1.033
Developer	44	10.454	2.723	.411
Manner of Processing				
Clarity				
External	30	4.833	1.510	.276
Internal	26	5.500	1.924	.377
Work				
External	30	10.233	3.170	.579
Internal	26	10.077	2.726	.535
Ways of Deciding				
Clarity				
Person-Oriented	30	4.833	1.783	.326
Task-Oriented	26	5.500	1.631	.320
Work				
Person-Oriented	30	10.067	3.062	.559
Task-Oriented	26	10.269	2.864	.562

Comparisons of Teams Based on Styles

A second set of analyses was computed to see if differences in productivity simply existed due to the type of problem-solving style. Teams with complete *VIEW* scores were categorized as Explorer vs. Developer, External vs. Internal Processor, or People- vs. Task-Oriented Decider, based on the hypothetical means (72, 32, 32, respectively) of the *VIEW* scores of the majority of the members of their groups. Table 4 also presents the descriptive statistics for these comparisons.

Table 4: Descriptive statistics for clarity and work scores for matched and non-matched teams.

	N	Mean	Standard Deviation	Standard Error
Clarity:				
Matched Teams	56	5.143	1.731	.231
Randomly-Made	9	4.556	1.944	.648
Work				
Matched Teams	56	10.161	2.947	.394
Randomly-Made	9	8.444	1.424	.475

An analysis of variance comparing teams "dominated" by Explorers versus Developers was statistically significant (F = 7.434; df = 1, 54; p = .01) on the variable of Clarity, with eta-square equal to .12 and power of 76%. Developers received higher ratings. The comparison on Work was not significant (F = 2.082; df = 1, 54; p = .16).

With respect to teams "dominated" by External or Internal processors, Clarity (F = 2.107; df = 1, 54; p = .15) and Work (F = .039; df = 1, 54; p = .84) did not exhibit significant differences. With respect to teams "dominated" by People- and Task-Oriented Deciders, neither Clarity (F = 2.107; df = 1, 54; p = .15) nor Work (F = .065; df = 1, 54; p = .80) yielded significant differences.

Discussion and Limitations

The initial purpose of this research was to examine the effects, if any, of problem-solving style on creative productivity. As mentioned above, the "level-style" distinction undergirding the development of *VIEW: An Assessment of Problem Solving Style* argues that style and creative productivity should not be correlated. There is some research to support this distinction, albeit with well-known tests of creative potential (Woodel-Johnson, 2011). In the present study, however, a large number of individuals who completed *VIEW*, were assigned to teams of similar styles, and then assigned a real task, to create a multimedia presentation. Thus, in this study, it was possible to examine the relationship of style to actual creative productivity.

The results presented above suggest that style and productivity can be related. While the "matched styles" hypothesis was not supported, there was a statistically significant difference in favour of Developer-dominated teams in the case of ratings of the clarity of the prompt expressed in their presentations. The observed power of this result was a high-enough level to warrant consideration.

To be sure, the limitations of this study are both theoretical as well as mechanical. While comparisons were made with each of the three *VIEW* dimensions, as mentioned above, teams were labelled one style or another based on the majority of members' *VIEW* scores. In reality, some teams contained a "minority" of members whose scores on one or more of the three *VIEW* dimensions were not "as extreme or consistent" with all the other members. A few teams "tied" in the number of members with scores above or below the hypothetical means. In those cases, the teams were labelled Developer, Internal, or Task-Oriented, respectively, in keeping with the rules governing official *VIEW* scoring (Selby et al., 2004).

One must also consider the hypothesis that any relationship between style and productivity may depend on the context, the job, or the task at hand (Treffinger, Isaksen, & Dorval, 2007). In the present study, the task was an academic one, required of students enrolling in college and, presumably, who were fairly able at academic work. The task was designed to be relevant to the students' course of study. Quite possibly, the initial effort on the part of students in their teams to meet their team members, to understand the task, and to organize themselves to begin work would be the most difficult aspect. Once the team got itself organized and responsibilities and work divided up among members, students could proceed on a more "individualized" basis, relying on their various academic skills which they have used successfully enough, one must assume, to get into college in the

first place. This is a reasonable explanation why Clarity might be the more affected variable than Work, thus resulting in the one statistically significant result with reasonable power.

Some might suggest that the three raters, the three authors of this study, could have been biased in their ratings due to the Experimenter or other effects. Would independent raters have resulted in different outcomes? Possibly, of course, but this criticism may be the easiest to defend against. As reported above, the individual correlations among the nine ratings by the three raters rarely exceeded .50. This suggests that, even using the same rubric, and with their extensive knowledge and background with VIEW and education, the three raters rated the same presentations differently. In addition, to compensate for any possible bias, a factor analysis was employed, yielding one measure, termed Clarity, that was independent of the primary factor, Work.

Another limitation also gives direction for additional research. No data were collected about the actual interactions among group members as they worked on their projects. How did they begin? How did they respond to each other? How did they make decisions, such as which prompt(s) or media to use, or even dividing up the work? What criteria were important to them as they made decisions? If there was conflict, why did such occur and how was it resolved? Problem-solving style is relevant to each of these questions. Style can affect the ways individuals act and react in all phases or stages of problem solving, whether generating ideas in expansive explorations of possibilities or efforts to focus down on one or a few ideas for taking action. If the "match-mismatch" hypothesis is to be pursued, future research should try to gather these types of behavioural data.

Finally, the individuals on each of the teams were not told of their *VIEW* scores or were offered information about their *VIEW*s and what problem-solving style was about until after the assignment was completed. If teams had known about their own styles or style generally, perhaps their work and interactions during the work period would have been different. Additional research should examine the effects of knowledge of style on performance.

Conclusion

What can be concluded from the data reported above? The Clarity result yielded sufficient power that its explanation must be considered. This result is not contradictory of *VIEW* or general educational psychological theory. This result seems consistent with the idea that on a new and basically academic task, individuals with strengths in working with rules and guidelines (Developers), using logic and analytic skills to complete an assignment within a deadline, would have an advantage.

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