

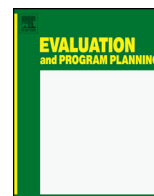


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# Concept mapping—An effective method for identifying diversity and congruity in cognitive style

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### ABSTRACT

This paper investigates the effects of cognitive style for decision making on the behaviour of participants in different phases of the group concept mapping process (GCM). It is argued that cognitive style should be included directly in the coordination of the GCM process and not simply considered as yet another demographic variable. The cognitive styles were identified using the Kirton Adaption-Innovation Inventory, which locates each person's style on a continuum ranging from very adaptive to very innovative. Cognitive style could explain diversity in the participants' behaviour in different phases of the GCM process. At the same time, the concept map as a group's common cognitive construct can consolidate individual differences and serves as a tool for managing diversity in groups of participants. Some of the results were that: (a) the more adaptive participants generated ideas that fit to a particular, well-established and consensually agreed paradigm, frame of reference, theory or practice; (b) the more innovative participants produced ideas that were more general in scope and required changing a settled structure (paradigm, frame of reference, theory or practice); and (c) the empirical comparison of the map configurations through Procrustes analysis indicated a strong dissimilarity between cognitive styles.

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## 1. Introduction

A distinguished feature of the Group Concept Mapping (GCM) method when compared to other similar methods (e.g., Affinity diagrams or Delphi) is that it shows in an objective way the shared vision of a group of experts on a particular issue. The methodology can also identify and compare participants on some individual characteristics, such as level of expertise, professional experience, educational background, job role, and gender, to mention but a few. The comparison of these individual differences is typically shown by GCM pattern matches and less often by sub-groups' concept maps. It is claimed that this type of analysis provides additional insight into the data, which is often considered secondary, although this is not always acknowledged explicitly. Cognitive style is an individual difference characteristic whose role in the GCM process, to the best of our knowledge, has not yet been

explored. Cognitive style refers to individual differences in people's preferred way of perceiving, organising and analysing information, and in particular, differences in how people manage structure as part of these cognitive activities.

There are at least three reasons why cognitive style should be included directly in the coordination of the GCM process and not simply considered as yet another demographic variable along with level of expertise, professional experience, educational background, job role, or gender. Firstly, cognitive style operates across all these individual differences. For example, both highly innovative and highly adaptive cognitive styles can be found at similar levels of expertise, professional experience, job roles, educational background, and for both genders. Secondly, cognitive style appears to have an impact on most of the phases of the GCM process. Differences in cognitive style can be observed in the types of statements generated, point map configurations, pattern matches and in suggestions made during the interpretation of the GCM outcomes. Thirdly, evidence-based cognitive style theories can predict individual behaviour, explain the reasons for differences in the behaviour of people, and suggest measures for managing diversity in groups.

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It has been shown that cognitive diversity has a greater impact on decision-making than demographic diversity (Jehn, Northcraft, & Neale, 1999; Williams & O'Railly, 1998). Likewise, cognitive style diversity is assumed to be a better predictor of team performance than traditional demographic variables (Miller, Burke, & Glick, 1998; Schilpzand & Martins, 2010).

At the same time, the concept map as a common, whole group, cognitive construct can consolidate individual differences and serves as a tool for managing diversity in groups of participants. It represents the shared cognition of the group (Salomon, 1997; Stahl, 2006; Van den Bossche, Gijssels, Segers, Woltjer, & Kirschner, 2011). In this paper, we combine two research paradigms – (a) cognitive style, and (b) group concept mapping – to demonstrate how they could lead to mutually beneficial insights. The cognitive style paradigm can contribute to predicting the behaviour of participants in different phases of the GCM process and to explaining differences in the participants' concept maps and pattern matches based on their cognitive styles. The GCM paradigm can first help us visualize individual differences in concept maps and then show how they can be consolidated in the whole group concept map. As a common, objectively identified, cognitive artefact, a group concept map can serve as a tool for managing diversity in cognitive style in addition to the ways proposed in the cognitive style paradigm. Based on findings reported in the literature on cognitive style and outcomes within the framework of a case study, this paper proposes a set of hypotheses that could guide future research on the role of cognitive style in the GCM process.

In the remaining sections of this paper, we first briefly review research on cognitive style to provide context for associating particular cognitive styles with different types of problem solving and decision making. Then we explore differences in the cognitive styles of the participants and show how these differences could be mutually beneficial for each other as observed in the outcomes of a GCM project. Finally, we discuss the results of the case study, formulate some conclusions, and make suggestions for future work.

### 1.1. Cognitive style – definitions and implications for the GCM process

Cognitive style refers to a psychological dimension that represents consistencies in an individual's manner of cognitive functioning, particularly with respect to perceiving, remembering, thinking, decision making and problem solving. Cognitive styles are assumed to be relatively stable over time; they are value free, possibly innate, and related to personality (Armstrong, Peterson, & Rayner, 2011; Kirton, 2006).

Some examples of cognitive style dimensions are as follows: 'field dependence-field independence' (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962); 'reflective-impulsive' (Kagan, 1966); 'serialist-holist' (Pask & Scott, 1972); 'converger-diverger' (Hudson, 1968); 'simultaneous-successive' (Das, 1988); 'wholist-analytic' (Riding & Buckle, 1990), and 'adaption-innovation' (Kirton, 2006), to name a few. For a detailed overview and classification of cognitive style, see also Riding and Cheema (1991), Jonassen and Grabowski (1993), Rayner and Riding (1997) and Zhang, Sternberg, & Rayner, 2012.

In addition to its impact at an individual level, cognitive style can affect the way teams function as well. Teams engaged in complex decision-making need to consider their task from different perspectives, thus increasing the likelihood that all relevant information is included, which results in better coverage of the task problem space (Hambrick, Cho, & Chen, 1996; Schilpzand & Martins, 2010; Williams & O'Railly, 1998).

Of particular interest to the objectives of this study are the cognitive style constructs defined in the context of problem-

solving and decision making, such as those measured by the Myers-Briggs Type Indicator (MBTI; Myers & McCaulley, 1985; Myers & Myers, 1995) and the Kirton Adaption-Innovation Inventory (KAI; Kirton, 2006), which are frequently referred to and used in research and practice (Armstrong, Cools, & Sadler-Smith, 2012; Franco, Meadows, & Armstrong, 2013). The Myers-Briggs Type Indicator (MBTI) has been used extensively as a cognitive style instrument, but it was not developed to measure exclusively cognitive styles; it identifies personality types. Specifically, the four basic dimensions of MBTI (i.e., sensing-intuition, thinking-feeling, judging-perceiving, and extraversion-introversion) produce 16 personality types when used in combination, which makes MBTI difficult to apply practically in the context of the GCM process. MBTI also associates personality types with particular professional occupations. Cognitive style research indicates, however, that within a profession, different cognitive styles will be present (Kirton, 1999, 2006). It has also been discovered that some of the MBTI items are related to capabilities (i.e., level-based constructs), not preferences (i.e., style-based constructs) (Kirton, 1999).

KAI is a pure stylistic measure, it is much simpler to use, and it is highly regarded. KAI is based on well-established theory that has been used in different academic and business domains for more than 40 years. Equally important, it has strong predictive power, high reliability, and extensive validity evidence. We turn now to a more detailed discussion of its underlying theory and applications.

### 1.2. Some evidence-based facts about Adaption-Innovation theory

Kirton's Adaption-Innovation (A-I) theory makes a strong distinction between style constructs and level constructs, including both potential level (e.g., intelligence and cognitive complexity) and manifest level (e.g., knowledge, competencies, or experience). Style and level do not correlate, as has been established in the literature (Kirton, 2006). A-I theory also distinguishes between style and observed behaviour. Style is stable over time, while behaviour is flexible when circumstances require it, resulting in coping behaviour. There is also a distinction made in A-I theory between style and process. A process (like GCM process) is an ideal template or roadmap for how we move through our problem solving. No stage in a process is associated with a particular style; instead, different cognitive styles can operate in each phase.

As a measure of cognitive style, the KAI Inventory locates people on a continuum that ranges from highly adaptive to highly innovative, with large general populations exhibiting normal distributions. Because cognitive style is stable, the KAI score people receive does not change over time; however, as individuals, they may fall on the more innovative or the more adaptive side of a particular group, depending on that group's overall style distribution.

In general, the more adaptive one is, the more one has a positive regard for structure (e.g., theory, guidelines, policy) and consensus, and the more one will prefer to problem solve by defining, refining, extending, and improving the current, generally accepted pattern, strategy, or paradigm. That is, the more adaptive tend to make things 'better'. In contrast, the more innovative one is, the less tolerant one is of existing structure and the less respect one has for consensus; that is, the more innovative tend to do things 'differently'. The more adaptive also tend to produce or offer a relative few sound and practical ideas within the borders of a particular paradigm, while the more innovative tend to generate many ideas as they try to work to the edges of (or even outside of) a well-established paradigm – possibly combining different paradigms. As befits a continuum, it is better to say "more adaptive" and "more innovative" when describing individuals, although the

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