Group Zig Zag: An Extension of Myers’s Zig Zag Model

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Abstract

As organizations increasingly rely on groups to solve problems requiring solutions spanning multiple functional areas and representing diverse constituencies, improving students’ group problem-solving skills has become an important issue in education. Research suggests that a large part of improving group problem-solving skills involves teaching students how to manage the influence of individual psychological preferences on group interactions effectively during the problem-solving process. This paper introduces a generic group zig zag (GZZ) model for facilitating group convergence in the problem-solving process by incorporating the E-I attitude preference into the original zig zag (ZZ).

The advent of computerized organizational information processing in the 1960s ushered in an era of unprecedented organizational change. The complex interplay between the rapid advancement of information technology (IT) and changes in the business environment led to profound changes in how organizations operate and meet goals. To achieve flexibility and speed in this rapidly changing and turbulent environment, the use of groups has become a fundamental unit of organizational structure (Drucker, 1988). More importantly, organizations increasingly rely on groups to solve problems that require solutions spanning multiple functional areas representing diverse constituencies.

Preparing college graduates to succeed in cross-functional groups composed of members from diverse backgrounds and constituencies poses a significant challenge to educators. In addition to teaching discipline-specific knowledge and techniques in the context of group-oriented tasks, educators must teach students how to manage and participate in groups effectively. To be successful, students must first develop group problem-solving skills. Second, students must develop disciplinary maturity, the ability to apply disciplinary knowledge to: (a) increasingly complex, large-scale problems in an innovative way; (b) disparate situations; and (c) collaborative environments. A major part of this development depends on the student’s recognition that a discipline is expressed and practiced by individuals. Because individuals have personality differences that influence their approaches to problem solving, competence in discipline-specific knowledge and techniques is a necessary but insufficient condition for successful group problem solving. To effectively engage in group problem solving, students must develop both a mature, holistic, perspective of their discipline and group problem-solving skills that incorporate individual differences.

The purpose of this paper is to present a generic group zig zag (GZZ) model for facilitating group convergence in the problem-solving process by incorporating the E-I attitude preference into the original ZZ. The remainder of this paper is organized into four parts. The next section discusses a convergence model of group problem solving. This is followed by a discussion of the GZZ model as an extension of the original ZZ model. The third section discusses three
levels of usage and includes a sample GZZ agenda. The final section discusses conclusions drawn from this study.

**A Convergence Model of Group Problem Solving**

Groups are formed for many reasons. In this paper, we focus on groups formed for solving a problem, i.e., groups commissioned to resolve a discrepancy between a current state and an unattained desired state. Group problem solving is assumed to follow some version of the typical four-phase process (e.g., Polya, 1957). In a group, there is some interdependence among members: dependence on each other’s services; sharing or supplying resources; making joint decisions; and coordinating efforts to accomplish an overall goal (Shonk, 1982). We distinguish Figure 1. Impact of Psychological Type on Development of Group Problem-Solving Skills. this from a team, which we view as a special type of group—one that works on a common goal requiring a cooperative effort among its members.

Group communication is central to successful group performance (Myers, 1979). An underlying theme in communication research is convergence, the tendency for two or more individuals to move toward a common point, or for individuals to move toward others and unite in a common focus (Rogers & Kincaid, 1981). The convergence model is based on the notion that group communication is a dynamic process of idea development through interaction with others. An individual’s communication patterns are assumed to result not only from the individual’s perceptions of the situation but also as a function of an individual’s perception of the orientation of others and an own orientation relative to others (Rogers & Kincaid). Convergence involves the emergence of a thread of coherence or common focus among group members, which is a prerequisite for successful group outcomes. Understanding, consensus, and collective action depend on a group’s ability to reach convergence.

To reach convergence, each individual’s attention must be oriented either in synchronization with others in the group or in such a way that it complements the orientation of others. An individual’s orientation to problem solving can be influenced by many factors. A considerable body of research has examined the relationship between personality characteristics and problem-solving strategies, much of which is based on Jung’s (1971) theory of psychological type as measured by the MBTI (Myers & McCaulley, 1985). For a review of this literature, see Huijt (1992). From this perspective, a group’s ability to reach convergence and arrive at a successful outcome is affected by the interplay of the individual preferences of each group member during the problem-solving process. This relationship is shown in Figure 1.

In Figure 1, group problem-solving outcomes are determined by the communication patterns of the group. Group problem-solving outcomes represent the degree of convergence reached by the group during each phase of the problem-solving process. Group communication patterns are managed through the application of various problem-solving techniques. The model in Figure 1 implies that individual psychological preferences moderate the relationship between communication patterns and group problem-solving outcomes. In this paper, we focus on an individual’s preference for the E-I attitudes during the problem-solving process as the critical moderating variable. If individual E-I attitudes are not synchronized, there is the possibility for communication dysfunctions (e.g., domination, blocking, and filibustering) to prohibit convergence, leading to unsuccessful group outcomes (Wilson & Hanna, 1990). In the next section, we describe a GZZ model for managing this moderating effect and facilitating...
the convergence process.

The Zig Zag Model

Research on the relationship between personality characteristics and problem solving suggests that consideration of individual differences is important both to understanding and enhancing the problem-solving process (Huitt, 1992; McCaulley, 1987; Myers & Myers, 1980; Slice, 1987). Myers (1980) described a four-step approach to problem solving that sequences Jung’s mental processes of sensing, intuition, thinking, and feeling. Myers suggested that the appropriate sequencing of mental processes should be sensing, intuition, thinking, and feeling. This sequencing prescribes a transition from the mental processes of perception (sensing, intuition) to decision (thinking, feeling). During perception, facts gathered

![Figure 2. Generic Diagram of Group Zig Zag.](image)

by sensing are analyzed by intuition for possibilities. During decision making, facts organized by thinking are evaluated by feeling.

Lawrence (1982) applied the phrase “Zig Zag Process” to Myers’s model and used it to examine individual strengths and weaknesses. McCaulley (1987) extended the discussion of the zig zag model by describing the influence of individual preferences upon the sequencing of mental processes. McCaulley also recommended a sequencing of attitudes: extraversion, introversion, judgment, and perception, for individual problem solving. The sequencing of attitudes was not reconciled with the sequencing of mental processes and is managed as a separate issue. Type theory suggests that individuals tend not to exhibit the recommended sequence of mental processes as a personal preference. For example, according to type theory, the “natural” preference for sequencing of mental processes by an INTJ is intuition, thinking, feeling, and sensing; for an ENFJ, it is feeling, intuition, sensing, and thinking. To assist in the use of the zig zag model, both Lawrence and McCaulley provided guidelines for managing the influence of individual personal preferences while applying the sequence.
**Group Zig Zag**

The importance of group problem solving in organizations makes it useful to extend the zig zag model to group problem solving and create a group zig zag. Successful group problem solving depends on managing the influence of individual psychological preferences (Figure 1) during the problem-solving process. We extend the sequencing of mental process of the original ZZ model by incorporating the E-I attitude into the group problem-solving process. Myers (1980) described E-I as two opposite preferences for where to focus attention. The synchronized orientation of each individual’s attention is critical for successful convergence. The GZZ is designed to facilitate the convergence process by providing a means of managing the influence of opposing attitudes, leading to a synchronization of attention orientation.

A generic diagram of the GZZ model is shown in Figure 2. Like the original ZZ, the model consists of four mental processes (S, N, T, and F), two attitudes (E and I), and two types of generalized transition states (the directed lines —>—>—>—> between mental processes or attitudes). The model is a representation of an individual’s mental processes and attitudes in a group problem-solving process. There is one representation for each group member. The movement of the directed line denotes mental process transitions along the “Z.”

The GZZ facilitates convergence by synchronizing the interactions of group members as they transition between the external exchange of ideas with others in the group (E) and the internal processing of their own ideas and the ideas of others (I). The GZZ diagram in Figure 2 provides the transitional structure for managing the influence of the opposing E-I attitudes. In practice, the GZZ provides an agenda (as the following example will illustrate) for facilitating group convergence by planning and managing the focal point of information absorption and decision making by specifying attitude transitions during each phase of the problem-solving process.

The diagram in Figure 2 is divided into two halves, corresponding to the attitudes E and I. The longitudinal movement of the directed line from one edge of the “Z” to the other denotes an attitude transition. Attitude transitions can occur within a mental process or during a mental process transition. The transitions in Figure 2 represent an abstract, stylized model of what transpires in a group problem-solving session. Actual implementations will be nonlinear, exhibiting considerable variation in the number of iterations of mental processes and frequency of attitude transitions.

**Sample Agenda.** Recent Computer and Information Sciences (CIS) curriculum guidelines (ACM, 1991; Davis, Gorgone, Couger, Feinstein, & Longenecker, 1997; Fournier, Longenecker, Feinstein, & Reaugh, 1993; Longenecker & Feinstein, 1991; Longenecker, Feinstein, Couger, Davis, & Gorgone, 1999) highlight the need for the development of group problem-solving skills across a curriculum. The first and foundational course sequence in a CIS curriculum is Computing I followed by Computing II. This sequence is designed to develop individual and group CIS problem-solving skills and a basic understanding and awareness of the concepts, theories, and paradigms of the computing sciences. A key concept underlying this sequence is the development of reflective problem-solving behaviors, or the consistent student adoption and usage of design methodologies. CIS research has shown that nonreflective (impulsive) student problem-solving behavior typically leads to incorrect, suboptimal, and incomplete CIS problem solutions, and that performance is improved when reflective behavior using established design methodologies is adopted (Merrienboer, 1988).

Each course in the sequence has a weekly and biweekly 1-hour lab session corresponding to the current lecture topic and homework assignment. Lab assignments are conducted in groups of three to five members. Each group is required to produce a clearly defined set of deliverables for each lab assignment, viz., a statement of the problem, an outline of the problem specifications, a set of data flow diagrams with data dictionary, and a control flow diagram or computer executable program. A specific amount of time is allocated for the production of each deliverable and is controlled by the facilitator.

For ease of presentation, the GZZ in Figure 3 has been flattened out so that the “Z” is represented as a linear strip of discrete mental processes. The transitional structure in Figure 3 provides an agenda for the facilitator in managing the group’s E-I attitude transitions during the group problem-solving session. For all mental processes, the group begins with I and ends with E. This structure reflects the general nature of CIS group problem-solving. Much of the work initially requires introverted activity followed by extraversion to reach a shared focus and to seek consensus. The transition path in Figure 3 is traversed at least once for each of the four lab session deliverables. Time permitting, groups are encouraged to perform multiple iterations of a path to refine and improve a deliverable. With each E-I cycle, the group converges on a common focus or shared understanding.
Implementation of GZZ in Curriculum Design: Three Levels of Usage

The preceding section described a generic GZZ model for facilitating group convergence in the problem-solving process by incorporating the E-I attitude preference into the original ZZ. In usage, the GZZ can be operationalized at three levels: individual; group; and organizational. At the individual level, the GZZ follows the sequencing of mental processes defined by the ZZ. At the group level, the GZZ provides an agenda for facilitating the convergence process. Through demonstration, practice, and the construction of agenda, students learn how to manage and facilitate this process by focusing on the development of effective transition patterns of the E-I attitude (an agenda). At the organizational level, the GZZ provides a step-wise approach for developing student group problem-solving skills and disciplinary maturity throughout the breadth of a curriculum. We define three levels of usage and envision that groups adopting the GZZ model will have a facilitator responsible for managing the problem-solving process. The facilitator monitors and encourages adherence to the specified mental process sequencing and the appropriate E-I attitude specified in the agenda. Student groups could consist of either an entire class or smaller subsets of a class.

Level I usage is designed for lower division courses (first-year or second-year students). The facilitator is either the instructor or a lab assistant and has at least Level 2 knowledge of GZZ implementation. The facilitator intervenes directly in the group to specify the mental process sequencing and transitions, E-I attitude transitions, and when to seek consensus or closure. Students are taught the underlying justification for the mental process sequencing (from the ZZ model) in general terms, with no reference to Jung’s theory of psychological type or the MBTI. No attempt is made to explain attitude transitions. The mental process sequencing is presented as a means of improving problem-solving skills and the application of formal problem-solving methodologies.

The focus of Level I is threefold. First, students are introduced to the ZZ as a means of fostering a more reflective approach to problem solving. By explicitly focusing on mental process sequencing and encouraging the balanced and appropriate exercise of the E-I attitudes, students develop a more reflective approach to problem solving. Reflective problem-solving behavior is the tendency to use formal problem-solving and design methodologies consistently and systematically (Messer, 1976). When students are not reflective—exhibit impulsive problem-solving behaviors—the likelihood of developing suboptimal or incorrect solutions is considerably higher. However, there must be balance. Students who focus too much on design issues, ignoring “real-world” constraints and concerns, can fall victim to “analysis paralysis” and develop equally suboptimal solutions. Second, Level I develops a familiarity and confidence in the ZZ mental process sequencing as an effective means of applying formal problem-solving methodologies. In order to participate in subsequent levels of usage effectively, students must begin the process of internalizing the concepts and perspectives engendered.
by the ZZ. Third, use of the GZZ in Level 1 begins the recognition that a discipline is more than a body of knowledge and collection of techniques and methodologies, that a discipline is practiced in a broader social context and engages an individual at multiple levels.

Level 2 is designed for use in upper-division courses (third-year students). At this level, a group member acts as facilitator. The instructor or lab assistant does not intervene in the group problem-solving process, i.e., groups are entirely self-managed. The instructor acts as advisor and coach to the group. In order to monitor group behavior and progress, groups submit a log and audio tape of each meeting.

Level 2 represents a more sophisticated application of the GZZ. Students are introduced to type theory and its relation to the mental process sequencing and attitude transitions. The group problem-solving process is discussed in the context of group convergence and the influence that the E-I attitude transitions can have on group outcomes. In Level 2, students are not introduced to the MBTI or to the influence that individual preferences for the E-I attitude can have on communication patterns and group outcomes. As a model for curriculum development, this makes the GZZ relatively independent of the MBTI and broadens the community of potential adopters.

Levels 1 and 2 do not require the instructor to be qualified to administer the MBTI and can therefore be used more widely throughout a curriculum. The focus of the GZZ in Level 2 is to present the group problem-solving process from a convergence perspective (Figure 1) and to convey a sense of how E-I attitude transitions influence this process and group outcomes. Once mastered, the GZZ can be used to solve a variety of problems in different contexts. Given the rapidity of change that organizations are undergoing and the increasing reliance on groups to solve cross-functional problems, it is important to teach students a generalizable, but flexible, model for participating in and managing group problem solving. The CZZ provides this model by focusing on the individual preferences common to all group problem-solving activities.

Level 3 is designed for senior-level courses. Groups are self-directed and self-managed, with the instructor serving as advisor and counselor. At Level 3, the MBTI is administered and students are informed of their types, given counsel about their preferences, and introduced to the terminology and concepts of the MBTI. Group problem solving is presented in the context of the influence of individual preferences. The focus of the GZZ at Level 3 is to transition to real-world problem situations and projects. At this point, students have become fairly proficient in GZZ use and the knowledge and methodologies of the respective disciplines, and are ready to transition to more complex, real-world problems and projects. Developing a richer appreciation for the social context in which a discipline is actually practiced facilitates this transition. In particular, students are made aware of how individual differences influence group outcomes and how those differences can be effectively managed. CIS curriculum guidelines

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express a need for students to be aware of the human side of software and systems development, but stop short of proposing a model for achieving it. Table I summarizes each of the three levels of usage.

At Level 3, the GZZ provides a step-wise approach for developing student group problem-solving skills and disciplinary maturity throughout a curriculum. The GZZ model lends itself to curriculum development for several reasons. First, the three levels of usage allow the model to be implemented stepwise through upper- and lower-division courses by employing increasingly sophisticated levels of usage of type theory. Level usage evolves from a highly unstructured, supervised lab environment with a thorough understanding of type theory (instructor managed) to a highly structured, unsupervised lab environment with a thorough understanding of type theory and how individual differences influence real-world group outcomes (self-diagnosis). This is especially relevant for disciplines characterized by multi-course sequences. For example, in CIS curricula, students progress from course sequences designed to teach fundamental concepts, techniques, and methodologies to intermediate course sequences designed to teach large scale system design, to capstone project course sequences designed to transition students to real-world system development. The levels of usage progress with and complement the level of sophistication present in each subsequent course sequence.

Second, because the GZZ is based on theories of individual personality differences, differences that transcend the specific techniques, methodologies, and domain knowledge of a discipline, the GZZ is generalizable to any discipline requiring the development of group problem-solving skills. Furthermore, within a discipline, it is important for a model to be flexible enough to accommodate the evolution of techniques and methodologies. This is especially true for CIS, a discipline that continues to experience phenomenal change and growth. Third, the GZZ model can be used in Levels 1 and 2 as a theoretical framework without administering the MBTI: Therefore, it can be used more broadly throughout a curriculum.

Conclusions

In this paper, we described a generic GZZ model for facilitating group convergence in the problem-solving process by incorporating the E-I attitude preference into the original ZZ model. This model provides an agenda for synchronizing individual attention orientation and group problem-solving sessions, leading to a common focal point of information absorption and group decision making. The usefulness of the GZZ can be considered at three levels of analysis: individual, group, and organizational. Through these three levels, the GZZ provides a curriculum-wide model for developing disciplinary maturity by fostering a recognition that a discipline is expressed and practiced by individuals and that individual differences factor into the success of collaborative efforts. This socialization begins with Level 1 usage and evolves into the full awareness expressed in Level 3 usage. Through usage of the GZZ, students develop a more mature, holistic perspective of their disciplines, a perspective that integrates discipline-specific knowledge and techniques with individual differences relevant to all collaborative activities.

References


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