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Recommended Citation

Duggan, Evan W. and Thachenkary, Cherian S. (2002) "JAD Can Get Better," *Journal of International Information Management*: Vol. 11 : Iss. 2 , Article 8.
Available at: https://scholarworks.lib.csusb.edu/jiim/vol11/iss2/8

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ABSTRACT

Interviewing and other conventional approaches failed to produce the user-developer understanding required to establish high-quality systems requirements for software development. Joint Application Development (JAD) was introduced in the late 1970's, and has been widely used to alleviate this problem. But JAD's success has been critically dependent on the excellence of facilitation to deflect many of the relational problems that are typically experienced with the freely interacting group structure used to conduct JAD sessions. While the use of JAD is pervasive, excellent facilitators are scarce, which hampers or even precludes some JAD efforts. In this article we recommend a solution to this problem—using the nominal group technique (NGT) in JAD sessions to reduce the impact of negative group dynamics on JAD results. We provide some indications of the potential effectiveness of this proposal.

INTRODUCTION

Systems requirements determination (SRD) requires effective user-developer cooperation to elicit, explicate, analyze, validate, and document user needs and the features and functionality that an information system should provide for them. This largely conceptual process is perhaps the most difficult, and arguably the most important step in the inherently complex software development life cycle (Brooks, 1987; Metersky, 1993; Zmud, Anthony, & Stair, 1992). It is critically impacted by the nature of the interaction among stakeholders (sponsors, managers, and users) and developers (Byrd, Cossick, & Zmud, 1992), but usually such interactions have been encumbered by their divergent interests and preferences (Vessey & Conger, 1994).

The quality of information systems is highly correlated with the quality of systems requirements (Byrd et al., 1992). High-quality requirements contribute to lower development costs and shorter development times by permitting earlier detection and correction of specification errors (Kang & Christel, 1992) and reducing the perpetual changes that expand the agreed application boundaries and result in creeping scope (Anthes, 1994). On the contrary, poorly specified systems lead to excessive maintenance, which siphons off resources that could be better allocated to other development efforts (Keil, 1995).

Until the late 1970s, interviewing was the dominant method used for SRD (Liou & Chen, 1993/94). The information obtained from all the parties interviewed was then aggregated as the set of system features to be designed. This approach has often produced inaccurate, incomplete, and inconsistent systems requirements, and was not conducive to easy identification and resolution of conflicting needs. Attaining consensus among the stakeholders challenged many system builders, who are typically more attuned to the technical rather than the political and social implications of software development (Franz & Robey, 1984).

Joint application development (JAD), a facilitated group technique, was introduced to confront these issues by focusing on the human factors of systems development (Wood & Silver, 1995). JAD pools the collective knowledge of users, their managers, and systems developers to generate agreeable decisions in a face-to-face workshop over several days (Carmel, Whitaker, & George, 1993). While JAD has provided noteworthy improvements over conventional methods, and has significantly reduced the time to generate requirements (Dean, Lee, Pendergast, Hickey, & Nunamaker, 1997-98, Dennis, Hayes, & Daniels, 1999), it uses the freely interacting group protocol, where communication occurs spontaneously and voluntarily. This exposes JAD sessions to many of the well-documented group problems that reduce its efficacy and makes good results critically dependent on the excellence of facilitation (Andrews, 1991; Kettelhut, 1993; Wood and Silver, 1995).

To further increase the effectiveness of JAD, we recommend applying the nominal group technique (NGT) at appropriate junctures within the JAD workshop to address many of the behavioral problems that have contributed to process loss during group interactions. NGT is also a facilitated group process that allegedly increases the decision-making effectiveness of groups engaged in creative problem-solving exercises (Moore, 1987) by reducing the negative impacts of social and emotional dynamics on the accomplishment of instrumental objectives (Ho, Lai, & Chang, 1999). We provide some indication of the potential effectiveness of the approach to support our argument that the amalgam of these seemingly, compatible, group structures can neutralize many of the dysfunctional behaviors frequently exhibited by decision-making groups.

In the rest of the paper we provide a more elaborate discussion of JAD, its advantages, and deficiencies, and examine the nature of the relational problems that have been observed in JAD workshops. This is followed by a brief review of NGT and some empirical indications of its applicability in group settings similar to those encountered in JAD workshops. Finally, in support of our proposal, we present three instances of the use of NGT with JAD. The first is a pilot study that compares JAD and NGT with JAD alone. The second discusses the observations (by one of the authors) of NGT used in a JAD workshop by a large multinational corporation, and the third reports on a trial run of NGT (at a professional facilitators conference) to generate high-level requirements for a simulated case.

JOINT APPLICATION DEVELOPMENT (JAD)

JAD originated at IBM in the 1970's as an alternative to conventional systems requirements elicitation methods. It supported systems analysis and design activities by bringing system

developers, managerial decision-makers, and other users together in facilitated, interactive workshops to develop jointly agreed decisions about the features, objectives, and scope of contemplated information systems (Andrews, 1991). Because of the encouraging results, IBM made the technique generally available to its clients, and over time, JAD developed and gained acceptance in the information systems industry. Its popularity stemmed primarily from the reduced cycle time and its potential to build team rapport and promote user involvement (Andrews, 1991; Anthes, 1994; Carmel et al., 1993; Wood & Silver, 1995).

As JAD's popularity increased, its application extended beyond the original intention. The D in JAD originally meant "design" but later became "development" to recognize its support for user-developer collaboration in other systems development life cycle (SDLC) activities (Wood & Silver, 1995). Some practitioners invoked the term joint requirements planning (JRP) to distinguish between its application for SRD and other SDLC phases. JAD is now known by several other names such as, joint application review, facilitated work sessions, facilitated workshops, accelerated design, facilitated meetings, joint sessions, modeling sessions, team analysis, user centered design (Carmel, George, & Nunamaker, 1995).

Although many organizations have implemented their own adaptations of JAD (Davidson, 1999), the formal JAD protocol consists of the following five stages (Wood & Silver, 1995):

1. Project definition to determine system objectives and scope and identify the JAD team

2. Pre workshop research on the problem domain and general systems issues

3. Extensive preparation and training for the JAD workshop

4. The three- to five-day workshop where the major deliberations occur

5. Preparation of the final document and obtaining its approval

JAD attaches immense importance to effective user-developer interaction and team rapport as preconditions for synergy (Purvis & Sambamurthy, 1997). This begins with assembling the right "JAD team," and appointing an excellent facilitator, whose role is pivotal (Carmel et al., 1993, 1995). The facilitator, who should be highly respected by the JAD team, enables effective communication by impartially guiding the group toward the accomplishment of the meeting objectives. He or she ensures productive use of the available time and tries to maximize participation. The facilitator requires excellent leadership and communication skills and good understanding of interpersonal relationships and business and systems analysis (Wood & Silver, 1995). Other JAD workshop participants include:

- An executive sponsor or his/her delegate, who charters the project, approves decisions, and supplies project resources, but he or she typically attends only the opening and closing sessions.
- The project manager—a business or IT representative who leads the application development team in the execution of the project.
- Several user/managers and other system users, who are domain experts that provide

information and make decisions about their respective business processes.
- A scribe or note taker who records and documents the deliberations but does not partici-pate in the discussions. In some cases the scribe may have special expertise such as data and/or process modeling skills.

- Non-participating observers may also attend.

Visual aids (flip charts and post-it notes) and other technologies (electronic white boards, graphics software) are widely used in JAD workshops to display requirements information, data and process models, and items deferred for further discussion (Andrews, 1991). More sophisti-cated JAD environments use CASE tools and GDSS technology (Wood & Silver, 1995), and although the JAD workshop is still largely a face-to-face meeting, a few JAD applications now include computer-supported cooperative work technologies to support virtual JAD sessions.

When applied successfully, JAD reportedly contributes to higher quality requirements (Dean et al., 1997-98), reduced scope and feature creep (Anthes, 1994), and lower development costs (Davidson, 1999) as a result of several of the following benefits (Andrews, 1991; Wood & Silver, 1995):

- Reduced cycle time for specifying systems requirements (from months to weeks).
- More accurate, complete, relevant, and internally consistent requirements because of immediate validation within the session.
- Less ambiguous requirements
- Improved team rapport and organizational morale and enhanced user-developer communi-cation and relationship
- Increased user involvement, which engenders commitment and ultimately system accep-tance
- Greater identification with the results and a sense of ownership of the project
- Educational cross-fertilization in which systems developers and users gain reciprocal understanding of their respective domains

However, these benefits are not always realized. The interacting group technique is the dominant process structure used to conduct JAD sessions. When groups deliberate in this man-ner, they experience several of the negative effects of group dynamics—problematic relational behaviors—that often impede the accomplishment of instrumental objectives (Delbecq, Van de Ven, & Gustafsen, 1986). Bostrom, Anson, and Clawson (1993) assert that an effective process structure should lead to effective relational behaviors that lead to effective task accomplishment. This point has been well recognized by many proponents of JAD, who have prescribed several JAD complements for encouraging constructive participation, overcoming groupthink, reducing destructive dominance, building consensus, and resolving conflicts (Andrews, 1991; Jessup, Connolly, & Galegher, 1990; Kettelhut, 1993; Misic & Graf, 1993; Wood & Silver, 1995).

RELATIONAL PROBLEMS EXPERIENCED IN JAD SESSIONS

Several relational problems that have contributed to process loss have been identified in group meetings generally (Nunamaker et al., 1992) and in JAD workshops specifically (Kettelhut, 1993). These may be attributable to conformance pressure, peer pressure and time pressure (Bostrom et al., 1993), which are common features of organizational life. The effects of these pressures have been observed in JAD sessions, especially because of the heterogeneity of the team with respect to rank, status, knowledge level, and psychological profile, and the high premium on participants' time. Some problematic behaviors are noted for each type of pressure.

Conformance pressure. Following are some relational problems associated with conformance pressures:
- Free loading—inadequate participation because of the threat of sanctions from the powerful, the fear to be thought a fool, unnecessary acquiescence to powerful and influential group members, or simply by election.
- Anchoring on peripherally relevant opinions and tangential ideas expressed by powerful participants, which leads to digression from the main agenda and disrupts complete and creative idea generation.
- Cognitive inertia due to fear of contradicting other members.
- Evaluation apprehension (fear of negative evaluation).
- Destructive dominance that allows influential group members to commandeer the process and suppress the useful ideas, opinions, and worthwhile contributions of other lowly ranked group members, which could result in inferior decisions that do not reflect the true preferences of the group.

Peer pressure. Relational problems attributable to peer pressure include:
- Groupthink—the fixation on preserving group harmony, which becomes the de facto decision criterion in cohesive groups. The group often insulates itself from important problem-solving information, which results in the erosion of its combined thinking capacity and leads to its failure to achieve synergy.
- The Abilene paradox—a side effect of conflict avoidance that causes group decisions that are contrary to the desires of its individual members. It may also be induced by time pressures to arrive at consensual decisions.
- Excessive socializing where the group engages in non-task discussions for extensive periods.

Time pressure. Time pressure typically gives rise to the following problems:
- Information overload as participants approach the threshold of human information processing capabilities because of the pace of the session.
- Incomplete analysis where solutions are generated before complete problem diagnosis.
- Commitment errors that occur when a group arbitrarily commits the resources of its organization to unattainable objectives and unrealistic targets because of inadequate schedule and/or resource evaluation.
- Goal setting errors that may similarly result from a group's unrealistic aspirations that ignore prior experience for similar projects.

JAD is critically dependent on the excellence of facilitation to deflect these relational problems during the workshop and diminish their threat to constructive decision-making. However, excellent facilitation is a scarce commodity (Carmel et al., 1993); it is not always available when it is required and some JAD efforts are not undertaken because such a person is not available. But Davidson (1999) has observed that even excellent facilitators are not always able to overcome these problems. Perhaps NGT, which was designed specifically to treat these types of group-related problems, and embodies (within its standard operating procedures) many of the prescriptions for improving JAD, could be interspersed appropriately within the JAD workshop to provide structural support to reduce the facilitator's burden.

THE NOMINAL GROUP TECHNIQUE (NGT)

NGT is also a facilitated group process structure that was designed to address the relational problems of freely interacting groups. It is particularly useful where group contributions must be assimilated, sifted, and then consolidated to produce a joint decision (as in a JAD session). It consists of the following steps (Delbecq et al., 1986), which may be modified to satisfy the decision context:

1. Individuals, working alone, silently generate ideas in writing for a specified period.
2. A facilitator methodically records ideas from each participant in a round robin format until all ideas are recorded. Participants may pass in a round in which they have no further contribution.
3. The ideas are discussed, clarified, and consolidated if necessary in preparation for subsequent evaluation.
4. Participants rate and rank the submissions and then vote by secret ballot.
5. Repetition of 3 and 4 if necessary.
6. Final decision-making based on voting.

Several factors account for its success. These include the separation of creative thinking from idea evaluation (Delbecq et al., 1986; Van De Ven & Delbecq, 1971) and the mandatory participation of group members proportional to their knowledge and expertise and not based on power and influence (Stephenson, Michaelson, & Franklin, 1982, Van De Ven & Delbecq, 1974). NGT's potential to reduce the impact of negative group dynamics on task-related objectives (Delbecq et al., 1986; Roth, Schleifer, & Switzer, 1995; Valacich, Dennis, & Connolly, 1994) is another, as is its easy-to-apply protocols that shield lower ranked group members from conformance pressure (Moore, 1987).

There is enough empirical evidence to validate the claim of NGT's effectiveness in a variety of decision-making circumstances. Van De Ven and Delbecq (1971) and Delbecq et al. (1986) confirmed its superiority over interacting group techniques and other structured methods used for problem solving and decision-making. NGT's contribution to decision-making effectiveness has been generally corroborated (Bartunek & Murningham, 1984) and particularly with heterogeneous groups engaged in solving complex, multidimensional problems (Frankel, 1987;

Stephenson et al., 1982). Gresham (reported by Korhonen, 1990) also found that participants expressed a high degree satisfaction with the process.

Henrich and Greene (1991) described and evaluated a successful application of NGT in a Fortune 100 company to identify roadblocks to an MRP II implementation project and to improve communication between members of the implementation team. NGT has also been used successfully in combination with other techniques. For example, Thomas, McDaniel, and Dooris (1989) used it in conjunction with multi-attribute utility to clarify strategic alternatives, and Teltumbde (2000) combined it with analytical hierarchy process (AHP) for evaluating enterprise resource planning (ERP) projects.

USEFUL INDICATIONS OF NGT PERFORMANCE IN JAD SESSIONS

The motivation for recommending the inclusion of NGT in JAD workshops as a possible cure for the relational problems that have curtailed JAD's effectiveness is based on previously highlighted, empirical indications of the successful uses of NGT. Although these were neither JAD nor SRD applications, the contexts were representative of the settings encountered during SRD under JAD: heterogeneous groups engaged in consensus-seeking, decision-making exercises.

Three scenarios that have further fueled this expectation are described next. The first was a pilot study conducted at a large urban university. The second describes the observations of one of the authors (as a non-participant) at a four-day JAD workshop for multinational pharmaceutical company. The workshop was led by a facilitator with a national profile who introduced NGT deliberations at appropriate intervals over the four days. The third scenario was a "trial" use of NGT to generate high-level systems requirements at the annual conference of a regional facilitator forum.

The pilot study

Thirty-two undergraduate students in one section of a Decision Sciences course were divided into eight groups of four to specify the requirements for a profitability analysis, decision model, which was later constructed for a course project. Four randomly selected facilitators conducted two sessions each (one JAD-like and one NGT/JAD) in two regular class periods (135 minutes each). Before the event, they were given a facilitator's packet containing a description of the project goals and instructions on how to conduct both sessions.

Immediately before the sessions, the instructions were further reviewed with the facilitators, and a separate debriefing session was conducted for the other participants. The groups were asked to document their finalized requirements at the end of the sessions, and complete a post-session survey. Three instructors, who taught sections of this course, rated the groups' completed requirements on the following:

1. The overall "goodness" of the features specified (on a scale of 1 – 100) compared to the known "ideal" solution.

2. The number of original (not in the solution) features specified.
3. The number of irrelevant features specified.

It was recognized that the sample size might have been too small to support statistically definitive conclusions. However the objective was to secure some directional indication of the relative effectiveness of the techniques. For the first measure ("goodness"), the mean for NGT-based process was higher than for JAD but not significantly so. In the other two cases NGT produced significantly more original features (a useful result) and significantly more irrelevant solutions (an unfavorable result). These latter results, taken together, may indicate that NGT contributes to greater conveyance overall, which may include both irrelevant and creative ideas, so that some care may be required in the validation of its output.

One seemingly plausible explanation for the absence of significantly better effects of the NGT intervention may be that the selected task did not generate enough disharmony or passion to induce dysfunctional, relational behaviors that would permit NGT to exhibit influence. In addition, it seems that some ambiguity may have resulted from facilitator learning over the two sessions. The facilitators arbitrarily decided the order in which they conducted their two sessions and the results were generally better for their second session regardless of process structure used. Perhaps randomly determining the order might have counteracted this problem.

JAD SUPPORTED WITH NGT AT A
MAJOR PHARMACEUTICAL COMPANY

The JAD session convened to specify requirements for the redevelopment of an inventory management system, included a diverse group of information technology specialists, pharmacists, sales consultants and managers, customer service representatives, financial and accounting professionals, marketing professionals, and administrative assistants. The motivational slogan for the workshop was based on one of the company's mission statements to "maximize reach by delivering doses virtually anywhere in the country 24 hours a day, seven days a week." The company's technology goal to deploy the industry's most advanced management information systems was often repeated as a morale booster.

NGT accounted for approximately 15% of the workshop time and was employed at convenient intervals for the following:

*   Determine objectives and goals for major systems components instead of low level requirements specification
*   Identify decisions that systems components were required to support
*   Identify the major sources of information needed to make those decisions
*   Generate use cases for particular event processes
*   Categorize and prioritize disputed information needs
*   Settle disagreements about alternative, competing approaches
*   Validate critical features by identifying potential problems or inconsistencies

Almost all the dysfunctional, relational behaviors associated with conformance and peer pressures were observed in the non-NGT segments of this workshop. For example, in a few of the JAD intervals some participants became de facto observers, and in one session there was overt manifestation of seemingly undue acquiescence to the wishes of an executive who stopped in for a couple of hours. It was also easier to identify participants of status in the JAD components than in the NGT intervals. Although the effects of time pressure might have been present, they were not easily discernible.

Relational problems including non-participation and domination were also noticed in the NGT sessions convened to resolve conflicts, particularly during the evaluation and clarification stages, but it seemed that the NGT protocol provided some compensation in the ranking and voting stages. It was more difficult to associate the emphatic preferences of powerful group members with NGT decisions than it was in the freely interacting sessions.

In the NGT sessions, there appeared to be less socialization and digression, as the deliberations seemed somewhat more focused and goal-oriented. It was evident, particularly at the start of the deliberations, that the NGT intervals suffered less from start-up inertia than the freely interacting processes. In the JAD sections, the participants expended greater effort in deciding on an analytical approach and the decision criteria that would be most suitable for that particular problem, while the NGT protocols were immediately invoked.

In several cases it seemed that the NGT intervention precipitated consensus, particularly because the participants were pre-committed to its use in those situations, and the participation of particularly introspective team members also seemed to increase during these intervals. Typically the facilitator introduced NGT when dysfunctional behaviors threatened to unreasonably prolong a session or produce poor decisions. On one occasion the NGT result reversed the decision preference of a particular manager. There were no immediately apparent recriminatory effects.

The fixation on achieving consensus and obtaining closure in JAD workshops may create conditions conducive to groupthink. It was noticeable after long (but not necessarily emotive) debates that the inclination to forge some harmonious compromise increased. This was rarely observed during the NGT sessions even if the process was accelerated. The NGT structure seemed to shield participants from the influences of both peers and superiors, and the process has a logical beginning and end.

One prominent observation was the considerable latitude the facilitator had in the freely interacting portions of the workshop. There were occasions when she prevented highly ranked participants from steering the deliberations into preferred domains and on several occasions cajoled introspective group members toward more active participation. We concluded that with a "weak" group, it would not have been difficult for her to manipulatively elicit responses to satisfy desired conclusions. Alternatively a more diffident facilitator might have shown more deference to the wishes of powerful, high-status participants. This range of potentially problematic facilitator effects on outcomes was not as glaring in the NGT portions of the workshop.

NGT DEMONSTRATION AT A REGIONAL FACILITATORS' CONFERENCE

This facilitator organization (formerly called JAD user group) is a not-for-profit professional organization and support network for practicing facilitators and users of their services. The organization was founded in the early 1990s to provide a forum where members could share experiences and expertise and exchange information about facilitation techniques. The organization sponsors periodic educational and training seminars in the application of specific facilitation techniques and group processes, and a full-day conference for facilitators and the business professionals they serve from a variety of practice areas.

At the instigation of one of the authors, NGT was demonstrated in one session of an annual conference to elicit requirements for a simulated case within a JAD setting. NGT was not well known by the attendees, but they methodically applied it in the role-playing exercise. In an informal discussion following the demonstration, participants and observers provided feedback on the technique and its potential. The discussants, many of whom were facilitators, expressed satisfaction with the process. The majority seemed enamored with the technique, although some expressed reservations about its restrictiveness in comparison to other techniques they had used.

One facilitator noted that that NGT replaced some of the "premium on good facilitation" with the more "pedestrian" capability to faithfully apply a process structure. Some facilitators suggested that adaptations should be sought to increase NGT's tolerance for deviation from its procedures without diluting its impact. Others suggested a pre-session warranty that participants would abide by NGT-generated results especially in highly politicized environments. Another suggestion was to allow for disproportionate submission of ideas from acknowledged domain experts (which, incidentally, NGT now accommodates because a participant may "pass" in a round in which he or she has no further contribution).

There were inevitable comparisons of NGT and JAD. One contributor felt that JAD appealed to team rapport (that comes from the sequence of forming, storming, norming, and performing) to produce a high level of commitment to the results, while the "enforced" participation of NGT may not be able to produce a similar effect. In this regard, another participant noted that this "social motivation" that JAD affords often contributes to creativity. Yet another noted that in JAD sessions several breakout sessions are typical to consider special issues and NGT would not be able to accommodate this division of labor. The obvious counter to all these points is that NGT is proposed merely as a JAD complement, to retain its acknowledged benefits and address its weaknesses.

Some of the benefits of NGT were probably not discernible from this exercise. The participants could not simulate the emotiveness and deep political turf issues and, especially, the power asymmetry that characterize real SRD processes. These contribute to pernicious problems like destructive dominance, anchoring, and subjective allegiance to self-proposed positions that are not supported by the group as a whole; these are some of the bases for the group pathologies typically experienced in JAD. On the contrary, participants in the simulated exercise seemed more willing to concede contested points than is typical in natural settings.

CONCLUSIONS

JAD is widely used and has provided several noteworthy advantages over conventional SRD methods. The primary focus of this paper is leveraging of JAD's strengths and reinforcing its weak areas. The recommendation, therefore, is to use NGT as an intervention technique at appropriate points within a JAD workshop to improve the quality of decisions, particularly in circumstances where dysfunctional behaviors encountered in JAD may otherwise produce poor results. Fairly successful JAD facilitators employ a variety of tools and techniques to keep their sessions fluid and help procure useful, agreeable decisions. NGT has demonstrably solved some of the problems that have challenged JAD and seems a likely and effective addition.

This NGT reinforcement of JAD is expected to have a dual effect. The first is the reduction of JAD's critical dependence on excellent facilitation for useful results: NGT seems to provide greater process support for JAD facilitators, so good facilitators may become better, and less skillful facilitators can enjoy reasonable results. If that occurs, NGT-supported JAD unimpeded by the unavailability of skillful facilitators, will become more accessible to address the pervasive problem of poor SRD. The second effect is the realization of benefits commonly associated with high-quality, user-generated systems requirements: high-quality information systems; enhanced user ownership and endorsement of the product; and the eventual commitment to its successful deployment, acceptance, and use.

REFERENCES

Andrews, D. C. (1991). JAD: A crucial dimension for rapid applications development. Journal of Systems Management, 42(3), 23-27,31.

Anthes, G. H. (1994). No more creeps! Computerworld, 28(18), 107-110.

Bartunek, J. M., & Murninghan, J. K. (1984). The nominal group technique: Expanding the basis procedure and underlying assumptions. Group & Organization Studies, 9(3), 417-432.

Bostrom, R. P., Anson, R., & Clawson, V. K. (1993). Group facilitation and group support systems. In L. M. Jessup & J. S. Valacich (Eds.), Group support systems: New perspectives, (pp. 146-168). New York: Macmillian.

Brooks, F. P. Jr. (1987). No Silver Bullet: Essence and accidents of software engineering. IEEE Computer, 20(4), 10-19.

Byrd, T. A., Cossick, K. L., & Zmud, R. W. (1992). A synthesis of research on requirements analysis and knowledge acquisition techniques. MIS Quarterly, 16(3), 117-138.

Carmel, E., George, J. F., & Nunamaker, J. F. (1995). Examining the process of electronic-JAD. Journal of End User Computing 7(1), 13-22.

Carmel, E., Whitaker, R. D & George, J. F. (1993). PD and joint application design: A transatlantic comparison. Communications of the ACM, 6, 40-48.

Davidson, E. J. (1999). Joint Application Design (JAD) in practice. The Journal of Systems and Software 45(3) 215-223.

Dean, D. L. Lee, J. D., Pendergast, M. O., Hickey A. M. & Nunamaker, J. F. (1997-98). Enabling the effective involvement of multiple users: Methods and tools for effective software engineering, Journal of Management Information Systems 14(3), 179-222.

Delbecq, A. L. Van de Ven A. H. & Gustafson, D. H. (1986). Group techniques for Program Planning. Wisconsin: Greenbriar Press.

Dennis, A. R., Hayes, G. S., & Daniels Jr., R. M. (1999). Business process modeling with group support systems. Journal of Management Information Systems,15(4), 115-142.

Frankel, S. (1987). NGT + MDS: An adaptation of the nominal group technique for ill-structured problems. Journal of Applied Behavioral Science, 23(4), 543-551.

Franz, C. R., & Robey, D. (1984). An investigation of user-led design: Rational and political perspectives. Communications of the ACM, 27(12), 1202-1209.

Gibbs, W. W. (1994). Software's chronic crisis. Scientific American, 271(3), 86-95.

Henrich, T. R., & Greene, T. J. (1991). Using the nominal group technique to elicit roadblocks to MRP II implementation. Computers & Industrial Engineering, 21(1-4), 335-338.

Ho, E. S., Lai Y. J., & Chang, S. I. (1999). An integrated group decision-making approach to quality function deployment. IIE Transactions, 31(6), 553-567.

Jessup, L. M., Connolly, T., & Galegher, J. (1990). The effects of anonymity on GDSS group process with an idea-generating task. MIS Quarterly, 3, 313-321.

Kang, K. C., & Christel, M. G. (1992). Issues in requirements elicitation. (SEI-92-TR-012). Pittsburgh: Carnegie Mellon University.

Keil, M. (1995). Pulling the plug: Software project management and the problem of project escalation. MIS Quarterly,19(4), 421-447.

Kettelhut, M. C. (1993). JAD methodology and group dynamics. Information Systems Management, 10(1), 46-53.

Korhonen, L. J. (1980). Nominal group technique. M. W. Galbraith (Ed.), Adult Learning Methods, (pp. 247-259). Florida: Krieger Publishing Company.

Liou, Y. I., & Chen, M. (1993/4). Using group support systems in joint application development for requirements specifications. Journal of Management Information Systems, 8(10), 805-815.

Metersky, M. L. (1993). A decision-oriented approach to system design and development. IEEE Transactions on Systems, Man, and Cybernetics, 23(4), 1024-1037.

Misic, M., & Graf, D. (1993). The interpersonal environments of the systems analyst. *Journal of Systems Management, 44*(9), 12-16.

Moore, C. M. (1987). *Group techniques for idea building*. California: Sage Publishing.

Purvis, R., & Sambamurthy, V. (1997). An examination of designer and user perceptions of JAD and the traditional IS design methodology. *Information & Management, 32*(3) 123-135.

Stephenson, B.Y., Michaelsen, L. K., & Franklin, S. G. (1982). An empirical test of the nominal group technique in state solar energy planning. *Group & Organization Studies, 7*(3), 320-334.

Teltumbde, A. (2000). A framework for evaluating ERP projects, *Internal Journal of Production Research, 38*(16), 4507-4520.

Thomas, J. B., McDaniel Jr., R. R., & Dooris, M. J. (1989). Strategic issue analysis: NGT + decision analysis for resolving strategic issues. *Journal of Applied Behavioral Science, 25*(2), 189-200.

Valacich, J. S., Dennis, A. R., & Connolly, T. (1994). Idea Generation in computer-based groups: A new ending to an old story. *Organizational Behavior & Human Decision Processes, 57*(3), 448-467.

Van de Ven, A. H., & Delbecq, A. L. (1971). Nominal versus interacting group processes for committee decision-making effectiveness. *Academy of Management Journal, 14*(2), 203-212.

Van de Ven, A. H., & Delbecq, A. L. (1974). The effectiveness of Nominal, Delphi, and interacting group decision making processes. *Academy of Management Journal, 17*(4), 605-621.

Vessey, I., & Conger S. A. (1994). Requirements specification: Learning object, process, and data methodologies. *Communications of the ACM, 37*(5), 102-112.

Wood, J., & Silver D. (1995). *Joint Application Development*, New York: John Wiley & Sons.

Zmud, R. W., Anthony, W. P., & Stair Jr., R. M. (1993). The use of mental imagery to facilitate information identification in requirements analysis. *Journal of Management Information Systems, 9*(4), 175-191.