12-2002

Data Visualization: Graphical Representation in the Evaluation of Experimental Group Therapy Education Outcomes

Randall E. Basham
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by Randall E. Basham entitled "Data Visualization: Graphical Representation in the Evaluation of Experimental Group Therapy Education Outcomes." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Social Work.

David A. Patterson, Ph.D., Major Professor

We have read this dissertation and recommend its acceptance:

John G. Orme, Ph.D., Charles A. Glisson, Ph.D., Charles B. Hamilton, Dr. P.H.

Accepted for the Council:
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Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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DATA VISUALIZATION: GRAPHICAL REPRESENTATION IN THE EVALUATION OF EXPERIENTIAL GROUP THERAPY EDUCATION OUTCOMES

A Dissertation

Presented for the

Doctor of Philosophy Degree

The University of Tennessee, Knoxville

Randall E. Basham

December, 2002

DEDICATION

This dissertation is dedicated to my grandfather Henry Walton Neylon who had limited opportunities in life, but continued to grow and inspire growth in others. He has resided independently in southern West Virginia for more than 100 years and has a second grade formal education. However, he demonstrated that intelligence, quality of life, and the accumulation of wisdom were not dependent on education, but that education provided the opportunity to choose your life's work. His advice for his progeny and admirers to mature and to prosper is to "walk about three miles every day, and keep worry far from your mind".

During his lifetime, he worked in the fields and at industrial facilities to put his siblings through school and provide them opportunities denied to him. He met his responsibilities as provider and caretaker for five generations. Throughout all of this, he maintained the grace and social skills that endeared him to those he met from the affluent and educated to the impoverished and disadvantaged.

ACKNOWLEDGEMENTS

I would like to acknowledge all of those who provided support or contributed to this dissertation. My sincere appreciation and thanks are extended to the following individuals:

To my wife, Sharon Basham, for providing support and encouragement, and for providing motivation to stay the course during my doctoral education and through many difficult times while making progress on this dissertation.

To David A. Patterson, Ph.D., my dissertation Chair, for providing me the opportunities to develop my writing and evaluative skills and the sponsorship to begin to disseminate my first scholarly efforts for the academic community including providing the motivation to complete this dissertation.

To my committee members John G. Orme, Ph.D., Charles A. Glisson, Ph.D., and Charles B. Hamilton, Dr.P.H. who have contributed to both my doctoral education and to the completion of this dissertation project.

To my mother-in-law Patricia A. Willming and father-in-law Robert L. Willming, who provided the emergency relief services to us during the first year of the program that permitted me to continue my doctoral education.

ABSTRACT

Introduction: An important methodological consideration in the social sciences is the evaluation of the effectiveness of groups and specific group interventions. There is an increasing demand for service accountability in practice settings both in social services and public health services. Group services are rising as a practice modality. Emerging technology shows promise of providing the means for practitioners untrained in advanced research methods to gain useful information and improved decision-making capacities related to groups and group services. Computer based graphical representation of data patterns at multiple levels of analysis can provide the bases for data exploration and lead to further advances in the evaluation of complex group dimensions associated with group effectiveness. Objectives: The purpose of this study was to evaluate group therapy experiential education outcomes using conventional data analytic methods for time series data. These include traditional methods of visual evaluation of single subject information, as well as, less common graphical representation methods that permit the simultaneous display of group process and outcomes and provide visual evaluation information across units of analysis. Methods: Group level time series data for 16 experiential group therapy education groups were evaluated using a variety of graphical and statistical methods. This study demonstrates a range of graphical representations, which provide differing levels of evaluative information and time series statistical information. The limitations of inferences available when evaluating non-probability samples were addressed. Results: Using widely available technology a number of graphical methods were demonstrated that present multilevel time series information to include group process and outcome simultaneously for both individuals and groups, as well as, for multiple variables of

change. Data visualization evaluative methods were presented that illustrate levels of group participant concordance and variability over time. Graphical representations were generated that demonstrate the proportional contribution of multiple variables to group outcome over time. Graphical representations methods were also presented that represent multiple levels of analysis over time and for multiple groups with varying durations of group length for simultaneous comparison over time. The difficulties associated with identifying autocorrelation in time series data and with non-probability samples using graphical and statistical methods were addressed.

PREFACE

The subject of the present dissertation is data visualization methods for evaluating group outcomes at multiple levels of analysis. A few years ago the technology was not available for service providers to consider evaluating service outcomes across multiple levels of analysis and presenting this information graphically for peers and consumers of services to understand the meaning of changes over time for multiple dimensions. Modern computing technology has advanced the human capacity to represent quantitative information graphically in much the same way as Pascal's arithmetic machine, first documented in Diderot's Encyclopaedie (1751), led to the invention of replicated ways of calculating large numerical values reliably. Although Pascal's original numerical calculator was available to a few, modern computing power has become available to most businesses, institutions, communities, and the majority of service agencies in developed nations. The invention of a graphical interface for computer applications which has only recently been widely distributed in 1995, has heralded a revolution in information management and broadened the potential for service providers to keep pace with the evaluative demands required for professional accountability. A few of the possibilities are investigated here as these relate to the provision of group intervention evaluation in social service settings.

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INTRODUCTION

Overview

Evaluating the multilevel change associated with group services and specific group interventions is an important methodological issue for practice based decision makers. Groups and subsequently group services are a part of the development, education, socialization, wellness and achievement of most members of a society. During the past half of a century, group work has become an essential method of social work practice. Group work includes a number of modalities such as intervention groups, educational groups, growth groups, mutual sharing groups, remedial groups, and task groups (Reid, 1997).

A single subject form of evaluation methodology that provides multilevel visual analysis of data for groups and group interventions is needed to provide support for group service decision making at the level of the agency setting and practitioner. The need is made more critical in light of demands for improved service accountability among practitioners (Bloom, Fisher, & Orme, 1999), the increase in overall group services in recent years (Spitz, 1996), and recent research findings indicating the potential for harmful experiences by group service participants (Smokowski, Rose, Todar, & Reardon, 1999). Much of the current evaluation methodology specific to practice evaluation is limited to single subject methods using individuals as the primary unit of analysis (Marlow, 1998; Royse, 1999). Sophisticated group research models that use pretest and posttest group comparisons require considerable time, and scientific knowledge to analyze. (Rubin & Babbie, 2000). Furthermore, research models do not provide the ongoing dynamic feedback needed by practitioners to monitor outcomes and change interventions as needed. The prerequisite resources of time and advanced analytical knowledge are not available to many practitioners. The needed group evaluation methodology would require consideration of the limitations placed on data collection and analysis, and of available methods of representing outcomes that are consistent with non-research practice settings (Patterson, 2000a). Evaluation results need to be meaningful to both the group participants, and the group practitioners who have limited research training or technical support. The methodology of necessity requires the building of a transformational bridge between the current intensive analytical knowledge of the social research scientist, and the service demands and sampling limitations of the practitioner environment (Hudgins & Allen-Meares, 2000).

There is ample evidence of a current body of research knowledge that demonstrates the effectiveness of group interventions. From this body of research knowledge we know that group interventions work (Hare, Blumberg, Davies, & Kent, 1995; Smith, Glass, & Miller, 1980). Whether a specific practitioner's group works is a more difficult evaluative question to answer. At present, practitioners are being pressed to provide greater professional accountability and to demonstrate the success of interventions and services (Bloom et al., 1999). Determining accountability in the provision of group services is difficult in practice settings. The limited availability of an applied group methodology in the evaluation literature may be a part of the difficulty. There are a number of more complex methodological and measurement strategies available in the group research literature (Busk & Marascuilo, 1992). These methods allow for the controlled analysis of group research projects, and are able to demonstrate the effectiveness of groups by compensating for design or measurement flaws (Nugent, Sieppert, & Hudson, 2001). Much of this literature addresses the unique measurement considerations involved in making meaningful inferences from group research (Pedhazer, 1997). This literature, however does not adequately address group evaluation concerns for the increasingly accountable practitioner who does not have the luxury of implementing scientific controls to evaluate the provision of group services.

Group evaluative tools are needed for a number of purposes. These purposes include client and practitioner self-evaluation, as well as supervision and administrative feedback. These evaluative tools need to be understandable to those involved in practice or the evaluation of practice, readily available in the majority of practice environments, and able to provide rapid evaluative feedback in the provision of group services so that mid-course group modifications may be made when needed. Individuals within groups that are not performing well could be identified. Dimensions of the group process could be continuously evaluated to identify problem occurrences related to process. Comparisons between groups offered under the same conditions and those offered under differing conditions could be evaluated. Generalizations could be made based on the replication of group results. Group evaluative information could be presented in a readily interpreted representation of multiple dimensions of group data. Supervisory and administrative feedback would be available at multiple levels of analysis and under a variety of conditions (Patterson & Basham, 2002).

Historically, group outcome literature has been criticized as being reductionistic, in that aggregated measures limit ability to evaluate group process and outcome at differing levels of analysis (Barlow & Herson, 1984). The selected unit of analysis such as the individual, the family, or the group is chosen in advance for the reporting of outcomes. Change in process dimensions over time is not a consideration in most selections, nor is the selection of multiple dimensions or units of analysis for the purpose of determining and reporting of outcomes. Measures such as pre-group and post-group reports are compared for aggregate change and reported as a single representative value. In the case of time series measurements; values at one level, or unit of analysis, are represented by a line of aggregated interval value changes at the level of interest (Barlow & Herson, 1984).

Evaluative methods that propose to measure group process and outcomes at multiple levels of analysis are needed to provide meaningful feedback at all levels where verification of change is desired. Emergent technology may offer the potential to develop practitioner friendly and widely available group evaluation tools for many aspects of the human services delivery system (Schoech, 1993). Graphical analysis and other data analytic approaches made available by recent computer applications and technical advances could prove useful in providing meaningful evaluative feedback for groups at the levels of the group participant, the provider, the group services supervisor, and the agency administrator (Patterson & Basham, in press).

Evaluation refers to methods of intentional analysis of outcomes in contrast to simply monitoring the process of an intervention. Therefore, selecting an appropriate methodology for evaluation of individual and group outcomes may be dependent on a number of factors. These factors include the type of group content and structure, the need to determine changes in the members' functioning over time, the social context of the group, and the combined group membership task to be accomplished (Bloom et al., 1999;

Tripodi, 1994). Also, there is an evaluative need to compare individual performance within a group to the performance or outcome of the group (Benbenishty, 1988).

Statement of the Problem

Social work practice has been historically strongly associated with the development of group level interventions and group level services. Social work practitioners provide services in a number of domains including public and private health services, public and private mental health services, children and family oriented programs, geriatric services, and community development programs. The demand and support for the provision of group service programs has been increasing in recent years. However, the development of methods to evaluate group services in practice settings has not kept pace with the provision of group services. For example, a recent meta analytic research finding related to the provision of group interventions during several previous studies suggests that as many as 40% of the participants involved with group level interventions report having personally damaging experiences (Smokowski, Rose, Todar, & Reardon, 1999). Though this finding is based on a single meta-analysis of earlier work, much of practice level group work has not benefited from a common, and consistently applied evaluative technology. The need to develop practice relevant methods of group evaluation that can provide information for practitioners, supervisors, administrators and policy evaluators is evident. Changes in the evaluative responses of members of a group engaged in an intervention can be transmitted and shared so that other groups can benefit from the evaluated change and thereby affect quality and outcome of human services organizations as a whole (Locke, 1976; Glisson & Durick, 1988). However, regardless of evaluation level, caution should be taken to assure that limitations in the interpretation of some evaluative methods are clear to the agency-based user. Group evaluative methods are needed that rely on analytic approaches to explore data patterns where there are few research level controls placed on the measurement of an intervention. There is also a need to draw inferences from group data at multiple levels at which persons engaged in an intervention may be affected.

The application of data visualization procedures for the evaluation of group treatment processes and outcomes has received strikingly little attention in the professional literature. Data visualization refers to a spectrum of graphical representation procedures used with complex data sets. The most commonly cited graphical representation method for evaluation of group treatment is found within the evaluative methods associated with single subject designs (SSD's). SSD's have traditionally employed line graphs for the visual representation of group treatment outcomes measures plotted across time. SSD's are often limited to plotting either mean group response scores or individual group members' scores. However, reports of the actual utilization of SSD's for the evaluation of group processes and outcomes are limited. Tolman and Molidor's (1994) review of research on social work groups found only two studies out of 54 used a SSD. Despite the paucity of attention to the use of data visualization procedures for assessment of treatment groups, evaluation procedures are needed to enable practitioners, supervisors, and administrators to measure and document the complexity of changes within group processes over time. An important challenge for data visualization within group evaluation is to develop creative tools that are easy to use, and readily available (Patterson, 2000). Such tools would include graphical methods that enable representation of multidimensional group processes across time. The methodological intention of this research study is to expand the available tools in SSD evaluation of groups by demonstrating the use of area graphs, surface plots and statistical process control charts to visually represent group processes and outcomes.

Objectives

Objectives for this research fall into three categories. The first and primary category is the demonstration of graphical methodology for representing group therapy experiential education outcomes. Objectives in this category include: (a) the demonstration of graphical methods of evaluating single subject designs for group level data using a spreadsheet software application and single subject evaluation software such as SINGWIN (b) the demonstration of available graphical methods to visualize the aggregation of group member scores (a measure of central tendency) while simultaneously demonstrating group concordance and variation (a measure of agreement and disagreement) over time (c) the demonstration of a graphical method to visualize the relative contribution of multiple dimensions of change over time within a group, (d) the demonstration of graphical methods to visualize attributes of group process and outcome simultaneously for one or more groups, (e) the demonstration of graphical methods to evaluate group data for multiple units of analysis simultaneously for one or more groups, and (f) the demonstration of a graphical method of representing replication of process and outcome over time and simultaneously for multiple groups of varying duration.

The second category of research objects focuses on the evaluation of group therapy experiential education outcomes. Objectives in this category include: (a) the determination of internal consistency, or reliability (reliability coefficient) for the measurement instrument used and identification of limitations to validity for the group evaluation instrument to assess dimensions of group satisfaction, (b) the identification of therapeutic change factors associated with participant satisfaction with group therapy experiential education, and (c) the determination and identification of limitations to making inferences for group level data in the absence of traditional research design controls.

The third category explores statistical analysis and methodological issues in the evaluation of group therapy experiential education outcomes. Objectives in this category include: (a) Evaluation of group change with conventional statistical methods to identify the limitations of statistical conclusion validity for time series group data collected without stringent research protocols, (b) the identification and description of inference limitations within associated with the data analyzed, and (c) the examination of the role of autocorrelation on time series observations with respect to score inflation due to cyclical error, and the potential for the misinterpretation of graphical representations when these visualizations are presented without accompanying statistical analysis.

Chapter II:

REVIEW OF THE LITERATURE

Review Method and General Findings

Multiple search strategies were used to assure that current or recent relevant group intervention literature and group evaluation literature were included from 1985 through 2001 with some additional sources being searched for earlier citations to 1975. Earlier references were included due to a lull in research in single case research and groups occurring at the end of the 1980's. Seminal works of a historical nature were included as these concerned the relationship between the development of social work as a profession and the concurrent development of group services as a primary intervention modality for social work. Additional background and historical or theoretical literature on group concepts was included to demonstrate previous inquiry into the development of group evaluation methods. The bibliographical search of twelve group evaluation and group intervention evaluation related key words or terms (analysis, data analysis, effectiveness, empirical, evaluation, graphical analysis, group, group intervention, measurement, outcome, statistical, units of analysis, surface plots and area graphs) were systematically completed in several databases. These databases included: (a) ABI Inform Global Ed., (b) Dissertation Abstracts, (c) ERIC, (d) Healthstar, (e) Medline, (f) Mental Measurements Yearbook, (g) PsychInfo, (h) Social Sciences Abstracts, (i) Social Work Abstracts, (j) Sociological Abstracts, and (k) Wilson Business Abstracts. Articles acquired through these searches were examined with attention to the title, abstract, and methods sections to determine the relevance of the article to the theme of the topic area for inclusion in this review. References included in the relevant articles were then collected for consideration of inclusion in the review.

Texts and original sources were also sought for this review from searches of the collections of several educational and federal lending libraries. Texts pertaining to the theoretical and historical constructs of group construction, development, effectiveness, evaluation, and research methodology, or those texts that were considered primary texts for the field of social work, were selected for inclusion in the review of conceptually related group issues.

There is a limited body of research on the evaluation of groups through use of single subject design methodology (Tolman & Molidor, 1994). This is surprising in light of recent findings that suggest that post-group casualty status due to traumatic experiences in groups related to leadership issues may be as high as 40% (Smokowski et al., 1999). However, scarce literature is available which demonstrates group evaluative methods for single subject designs (SSD's) that address the unique complexities of group measurement and interpretation of data results in practice environments.

Single subject designs as a method for evaluating practice have been reported in the literature since the late 1960's (Thyer, 1992). These designs have also been advocated for the evaluation of practice in leading social work textbooks (Bloom et al., 1999; Tripodi, 1994) and seminal research articles (Kazi, 1997; Mattaini, 1996; Jayaratne, 1977). Furthermore, group intervention has been, historically, an important mode of intervention since the earliest years of the profession (Marsh, 1931; Pratt, 1945; Reid, 1997). Group methods have endured as an important practice modality. These methods are reported to be increasing in utilization in recent years as practitioners respond to health care needs for cost containment efforts (MacKenzie, 1995; Spitz, 1996).

Historical Review

The earliest professional writings on groups have been traced back to 1906 when they were used in conjunction with medical training and education. Several pioneers of early group work development included John Hersey Pratt, Edward Lazell, Cody Marsh, Trigant Burrow, Alfred Adler, and Rudolph Dreikers. Most early developers saw the group process or task as an essential factor in the growth or advancement of member goals. Nearly all of these developers identified training and education as useful functions for groups and group interventions (Ettin, 1988).

During the first quarter of a century of development, group therapy pioneers attempted to delineate the therapeutic or curative factors, practice and group logistics, and role considerations for the therapist, and process considerations for the group. For example, Marsh proposed that mental illness was a social disease caused by the group which must be healed by the group (Marsh, 1931). Adler and Dreikers identified several therapeutic factors and therapeutic goals, which included cohesion, fostering cooperation and social harmony, and affirming the creativity and wholeness of each individual member (Dreikers, 1959). Joseph Pratt maintained that an advantage of group treatment could be found in the ability of the group to sustain gains in mental tranquility of individuals recovering from health problems (Pratt, 1945).

Social Work and Group Work Development

The development of group work as an intervention is closely tied to the emergence of both clinical social work and the settlement house movement in Europe and

America. Small groups were used to educate the poor and needy, or for socialization activities and missionary work. Groups were used as a means of treatment for drug addiction at Hull House in the early 1900's. Further social experiments with group work raised questions about the purpose of group work in the first third of the twentieth century. However, group work became increasingly common in clinical settings during the 1940's, with the acceptance of this mode of helping as a formal part of social work by the 1950's. Thereafter, the profession observed an expansion of various group intervention approaches (Reid, 1997).

World War II saw an expansion of the acceptance of group work of various kinds in America. Groups were a method of socialization for military personnel, and a method of healing for injured soldiers. Groups during the war also contributed to family and community programs to support the war effort. Group method developers from central Europe became refugees during this period and also influenced approaches to counseling and health care services in the United States. Group work became common as an effective intervention through a series of community based experiments in working with troubled youth and medical and mental health services following the war (Reid, 1997).

Then, in the 1950's group work became associated with social work, and was simultaneously seen as a social movement, a method to strengthen democratic ideals through citizen action, and a method that held the potential of creating permanent change in individual personality. Group interventions became associated with a broader range of problems. Consequently the need to develop methods to assess group intervention effectiveness during the 1960's and 1970's emerged (Reid, 1997). Group work continues as a major service modality in social work practice.

Constructs Associated with Group Change Theories on salient variables that affect the outcome of groups and group interventions have consistently evolved over the past century of group work utilization. Traditionally these theories and associated evaluative mechanisms have focused on the individual within the social group situation, rather than on the group as the unit of theoretical conceptualization (Smith & White, 1983). Curative or therapeutic factors affecting individuals within groups are well established in the literature. A number of novel ways of evaluating the individual's role or influence in the group, and the success of completing the group task have been devised (Blumberg, 1983; Polley, Hare, & Stone, 1988).

A number of factors then are thought to influence group outcomes. These are generally referred to as "therapeutic" or "curative" factors in the literature (Reid, 1997; Toseland & Rivas, 1995; Yalom, 1995). They have been the subject of both clinical and empirical research and provide a conceptual basis for group evaluation and describe constructs of interest for those hoping to understand the complexities of group work.

Yalom (1995) has identified through prior research and clinical observations a listing of eleven primary therapeutic factors, or constructs, in intervention groups that may be considered for assessment or measurement. These therapeutic factors may be identified as:

1. The installation of hope within the group process, which is utilized to motivate the group member to consistently attend the group, reinforce positive expectations, and reduce negative perceptions;

2. Universality, or promotion of the understanding that members are not alone or unique in their problems, and that disconfirmation of uniqueness is thought to offer a sense of relief to group members;

3. Imparting information to group members, or didactic instruction and direct advice that are used by group leaders and group members to provide information exchange and mutual support for group members;

4. The level of altruism present in the group, which promotes understanding that group members receive through giving to other members;

5. The potential for corrective recapitulation of the primary family group, or the concept that the group has similarities to each member's original primary group, the family, and that interactions within the group may mimic or serve to resolve previous negative interaction patterns of some members;

6. The development of socializing techniques, or the capacity of the group to assist in the development of essential social skills for members who would benefit from social skill development;

7. Imitative behavior among group members, referring to the modeling capacity of group leaders, or other group members which promotes a number of competencies in terms of tasks, or behaviors;

8. Interpersonal learning, includes developing an understanding of the importance of interpersonal relationships, the capacity of the group to provide corrective emotional experiences;

9. Group cohesiveness, includes a number of concepts such as the members' sense of acceptance by the group, the overall sense of 'we-ness' of the group and the

senses of greater solidarity of the group, which contribute to mutual support, attendance, and group participation;

10. Catharsis, or the capacity of the group to permit the expression of positive or negative feelings to one another and the group leader, and to be openly expressive; and

11. Other existential factors, such as learning to take ultimate responsibility for life choices, understanding the unfairness of life at times, and that no matter how close we get to someone, that each person must face life alone (Yalom, 1995).

However, Reid (1997), when referring to both intervention and non-intervention groups in the professional activities of social workers, proposes that self understanding, reality testing of members, group acceptance, freedom to self-disclose, and the degree of perceived guidance offered by the group are also worth consideration as group evaluative constructs. Reid does not include Yalom's constructs of recapitulation of the primary family group, catharsis, and existential factors as therapeutic factors related to all groups. He further proposes an evaluative instrument which consists of a preliminary seven item Likert scale instrument which may be devised by group workers to evaluate group member reaction or satisfaction per each group occurrence (Reid, 1997).

An earlier review of the theoretical, empirical, and clinical research published between 1955 and 1979 conducted by Bloch, Crouch, and Reibstein (1981) addressed therapeutic factors as specifically related to group psychotherapy. At that time, the review noted that approximately 40% of the research was empirically based. Much of the research literature utilized participant response for evaluative purposes. Participants of group work simply listed what was most helpful in their group. These items were later assigned to up to nine categories of therapeutic factors by independent raters in a number of Q-sort projects conducted in the 1940’s and 1950’s. Eventually a formulation of ranking strategies of factors was developed (Bloch et al., 1981).

Bloch et al. (1981) also recounted that much of the research confirmed the original classification of therapeutic factors established by earlier theorists Corsini and Rosenberg in 1955. However, selected models of specialized groups incorporated specific rather than a uniform set of therapeutic factors (Benbenishy, 1988; Bloch et al., 1981). A common dominant global and individual level therapeutic factor related to positive group outcomes was subsequently identified, which has since been referred to as group cohesion.

<u>Evaluating Group Cohesion</u> Group cohesion is used as a dimension of evaluation for determining outcomes related to the overall group process rather than a specific group task. Cohesion is defined as the resultant of all the forces acting on all members to remain in the group. That is, cohesion represents the sense of solidarity of the group as a whole, but may also be thought of as the individual member’s attraction to the group. Therefore, cohesion is at once a variable which though, subjective, may be measured as a global group construct and individual sense of belonging and warmth for the group which may contribute to performance and outcome (Yalom, 1995).

Cohesion has been an emphasized global and individual therapeutic change factor related to positive group outcomes by several previous theorists, and has been included in most group research studies over the past half of a century (Reid, 1997; Toseland & Rivas, 1995; Yalom, 1995). Cohesion then is considered as an evaluative criterion of primary importance. Cohesion is recognized as a contributor to outcome in group psychotherapy (Marziali, Munroe-Blum, & McCleary, 1997). However, decades of theoretical and empirical research on cohesion have revealed that the development of group cohesion requires a number of preconditions and early group conditions within the group.

Preconditions for group cohesion include selection of suitable participants, balanced group composition, and effective group orientation, training, and contracting. Early group conditions for cohesion development include the capacity of the group to resolve conflict, constructive development of norms, group culture building, and the reduction of avoidance and defensiveness of members (Braaten, 1991). Group cohesion then may be divided into five factors. Cohesion dimensions or factors are thought to include: (a) attraction and bonding, (b) support and caring, (c) listening and empathy, (d) self-disclosure and feedback, and (e) process performance and goal attainment (Braaten, 1991). However, the evaluation of cohesion may require that participant behaviors related to cohesion vary according to the phase of group work. Specific types of member behavior may be related to cohesion at certain phases of group development but may not be related at other points (Budman, 1993).

<u>Other Approaches to Group Evaluation</u> Previous approaches to group evaluation have included efforts to attribute causality of successful outcomes to theoretical models of intervention. Theoretical explanations have often not had the benefit of rigorous scientific methodology (Spitz, 1996). Furthermore, theories associated with evaluative mechanisms have previously focused on the individual within the group situation rather than the group as the unit of theoretical conceptualization (Smith & White, 1983). There

has been, however, a gradual movement toward methodologies to evaluate the effectiveness of individuals or entire groups in the accomplishment of specific outcomes (Rose, 1989). Areas for consideration of evaluation at various levels of analysis in small group research now include both process and outcome (DeLucia-Waack, 1997).

Visual inspection of data patterns from a graphic display has been the traditional method of data analysis in the single subject design literature (Parsonson & Baer, 1992; Parsonson & Baer, 1986). Line graphs such as those used with multiple baseline design, and strip construction designs have been used heavily to display scores that are associated with different dimensions of interest in single subject designs (Mattaini, 1993). Individual scores, averages, or a set of dimensions are visually displayed to offer a basis for comparison between phases or changes. Representations of data trend or change are based on level of change, central tendency, trend, and variability of scores. These representations are commonly presented as descriptive statistics. Inferential statistics are rarely used. Values are presented visually as an aggregated line of scores or data points that attempt to display the change at different phases or portions of the group process (Nugent et al., 2001). Replication from one situation problem or setting to another becomes the basis of generalizability of results across single subject designs that are not well controlled (Bloom et al., 1999; Barlow & Herson, 1984).

Presenting data in an understandable way for practitioners in a format that considers the representation of multiple units of analysis and multiple dimensions, for meaningful review of process and outcomes, is an issue of concern in the evaluation of groups. Small group evaluation in practice settings allows limited options with respect to determining causal connections and generalizability. (Bloom et al., 1999; Orme, 1991).

Also, observed characteristics of individuals cannot always be generalized to characteristics of their groups (Rubin & Babbie, 2000). Similarly, whole group comparisons are restricted in their capacity to draw inferences about individual change related to an intervention in reported psychological research models (Kazdin, 1998). Selection of the whole group as a focus of intervention success, or of individuals within the group determines the research focus for the effectiveness of the specific group or of the intervention (Toseland & Rivas, 1995). However, there is little empirical research that compares the two modalities of individual and group interventions using the same measures (Hill, 1990). Group comparison studies that rely on random assignment also have differences in interpretation of results at different units of analysis (Schaeffer, Mendenhall, & Ott, 1996). When two or more groups are compared, individual variability within groups is masked. (Jayaratne, 1977; Nugent, 1996; Schneider, 1990). With respect to other measurement considerations, correlations may be significant at one level of analysis and not at another. Similarly, regression coefficients may change direction or be significant at one level of analysis and not at another (Glisson, 1986). These issues further obscure the interpretation of individual verses group process and outcome.

Recent literature addressing the need to examine both process and outcome simultaneously in practice was identified (Hill, 1990), as was aggregated single case data analysis methodology (Nugent et al., 2001). However, literature that examined multiple units of analysis in single subject designs with groups and group evaluation could not be found within the scope of this literature search and review. There exists a gap in knowledge on how to represent change over time in groups for the purposes of adequate evaluation at multiple levels of analysis.

Group Evaluation and Data Visualization

Three substantive areas of the literature inform the issues of data visualization and of multiple units of analysis in single subject design group research. These include: (a) group evaluation literature including the unique measurement properties of groups, group evaluation in single subject designs as applied to groups and group measurement instruments, (b) graphical representation of data or data visualization across units of analysis, and (c) discussions of available computer technology such as spreadsheet programs that would enable data visualization as a means of group evaluation within many practice settings.

Group Evaluation Literature

Group evaluation concerns the verification of observations and hypotheses under conditions that are not sufficiently rigorous for group research. Group research is concerned primarily with determining causality and generalizability, whereas this is of secondary concern with evaluation. Enhancing outcomes for individuals or groups is of primary concern with evaluation, but is a secondary concern of research (Bloom et al., 1999). Therefore, a distinction must be made between practice level need for group exploration and evaluation and the confirmatory and predictive methodological approaches included in scientific group research (Tukey & Tukey, 1988a). Although predictive analytical methods may be undertaken with data that have not been collected using scientific controls, the reliability of generalizations made will likely be limited to the group of interest only until the obtained results have been replicated sufficiently. Though group research is rarely based on sampling methods that use probability sampling, methods such as random assignment to an intervention condition, matching of sample characteristics to be compared, or advanced statistical procedures are used to provide some level of control for sample comparison. These methods are not common or not available in most practice settings. Replication of results then provides a basis for making generalizations. (Rubin & Babbie, 2000).

Group Evaluation as Verification

Large numbers of people are seen in practice settings. Individual clients frequently differ with respect to their problems or concerns. Obtaining a probability sample of individuals with a particular problem of sufficient size to create comparison groups is not possible, or is very difficult, in smaller institutions, but may be possible in some larger institutions. However, creating probability samples in these settings contributes substantially to the cost of conducting such group research. Alternatively, group evaluation may provide essential information to key decision makers and service providers by verifying individual and group change under specified conditions and over time without expending the resources generally associated with group comparison research. Such resources frequently include demands for paid interventionists, data collection personnel, data analysis specialists, and a number of other routine costs (Rubin & Babbie, 2000; Lacher, 1997).

Group Evaluation or Group Research

Group evaluation must be differentiated from group research. Evaluation is concerned with process and outcome effectiveness and its potential to enhance outcomes for particular individuals or groups and is also used for purposes of determining whether a service or intervention may be verified to be providing the level of change expected for purposes of practice accountability, or administrative review. Group research however, is concerned with determining the reproducible and predictive aspects of the intervention or service that account for a hypothesized amount of expected change and uses rigorous controls to rule out competing explanations for expected change. In many instances the controls needed for group research are at odds with the practice environment. Therefore group evaluation may be expected to be the likely method for determining effectiveness and accountability in many practice settings (Bloom et al., 1999).

Verification of process results that occur in group practice settings may require different approaches than comparing two or more groups using a limited number of measurement occasions (e.g. pretest and posttest). However, there are some developing graphical methods for capturing information of multiple process dimensions within a single group session that may be compared at discrete time intervals (Beck & Lewis, 2000). These three dimensional bar graph comparisons are static and do not adequately address the complexities in evaluating a number of subjects, dimensions, or a number of groups with respect to change over time (Patterson, in press). Methods are needed that serve to verify process results in the provision of group services.

Group Evaluation Design Concerns

Average between group differences are the primary concern of group research designs. Within group comparison research, the average differences between pretest and posttest intervention are the primary concern. This is true for both within-subject designs, and pretest-posttest designs. Variability in differences is often attributed to measurement or random error (Rubin & Babbie, 2000). However, variability among individuals within a group may not be due to measurement error and the influence of extraneous or uncontrolled variables. Variability may also be due to an intervention being more effective for individuals fitting certain profiles. Certain intervention or group conditions may be more effective for some individuals than for other individuals in other circumstances, or under other conditions (Nugent et al., 2001). Single subject designs overcome this limitation of between group designs.

Single subject research designs have been offered as a methodology for promoting practice accountability since the 1960's (Thyer & Thyer, 1992). They remain a heavily endorsed method for the evaluation of practice outcomes (Anastas & Macdonald, 1994; Bloom et al., 1999; Cournoyer & Klien, 1999; Nugent et al., 2001; Royse, 1999; Rubin & Babbie, 2000; Tripodi, 1994). However, questions concerning the validity of the findings or decisions associated with single system designs have been reported over the past 20 years (Bloom et al., 1999; Jayaratne, Tripodi, & Talsma, 1988; Orme, 1991)

Significance and Hypothesis Testing

Significance levels and hypotheses testing results at different levels of analysis within group research and group evaluation will likely differ. These differences are not necessarily due to measurement error at any specific level of analysis. Measures of change for individuals or groups may be valid for each level of analysis represented. Hypotheses tested at different levels may appear to have contradictory results at different levels, but may be nonetheless valid for the level evaluated. Aggregated measures may appear to contradict raw scores, or measures occurring at some specified subgroup or unit of subjects evaluated. Furthermore, time series evaluative data may demonstrate problems with time, or serial dependent correlations of measurements at one level of analysis, that occur differently, or with some variability at another level of analysis (Glisson, 1986).

Statistical Conclusion Validity

Are the statistical conclusions drawn from analysis of single subject, or single system, research designs valid? Statistical conclusion validity is concerned with whether a relationship exists between an intervention and an outcome. Are making statistical inferences appropriate when the design is evaluative and concerned with enhancing the outcomes of individuals? Evaluating practice outcomes for individuals does not necessarily emphasize the making of inferences or the prediction of future occurrences of outcomes (Orme, 1991).

Statistical conclusion validity occurs when a correct decision concerning a research hypothesis is made. However, two types of statistical conclusion errors are possible. These are commonly known as Type I and Type II errors. Type I errors are associated with drawing a false conclusion that a relationship exists between two variables where none exists. Type II errors are concerned with the denial of an effect that does exist, and are most often due to the use of a limited number of observations or attempts to detect small effects. (Orme, 1991).

Risk of Type I errors associated with multiple comparisons whether planned or unplanned can be reduced further by using multiple comparison tests. A Bonferoni test which corrects the obtained probability value for a specified number of pair-wise comparisons may also be used. However these tests have been established for use with group comparison designs rather than single subject, or single case designs (Bloom et al., 1999; Orme, 1991; Crosbie, 1987).

Both Type I and Type II errors may be avoided by utilizing factors that increase statistical power where possible within the research design. Statistical power may be increased by increasing the number of observations, in time series designs, by increasing the sample size in between-group research, by choosing to test unidirectional hypotheses, or by making the alpha value larger and by selecting the most powerful statistical test possible for the available data. The probability of a Type II error may be minimized to .20 or below with power maintained at or above .80 using these approaches. However, this requires the foreknowledge and training associated with advanced research skill, and a rigorous and proactive approach to single-subject design studies that may have limited utility in many practice environments (Bloom et al., 1999; Cohen, 1992; Orme 1991).

Other reasons for statistical conclusion validity issues with single subject research include the phenomenon of autocorrelation (Barlow & Herson, 1984). That is the tendency for time series data to have correlated measures at differing intervals of observation, or problems meeting the statistical assumptions needed to analyze data using a statistical test (Bloom et al., 1999). Autocorrelation in single subject designs is discussed in detail under the sections of the narrative concerned with statistical significance detection in single subject designs, the literature on methodology in the research methods section, and in the data analysis section of the research methods

The assumption of independence of observations may be violated as well in single subject designs. That is, a participant score on dependent measure may have been influenced directly or indirectly by one or more other participants, or by other participant scores. This violation of assumption of independence needed to select a specific statistical analytic technique may be testable. However, tests of statistical assumptions are rarely conclusive (Orme, 1991). Statistical tests may be substituted that do not rely on the statistical assumption of interest, but this frequently requires use of a more complicated statistical test.

The recommendations for increasing statistical power may be difficult to implement in practice settings and in single subject designs with groups. Conflicting practice guidelines for the total number of meetings or total opportunities for observation may be at odds with these research recommendations. The total number of meetings in group interventions may be few, with limited numbers of observations. Numbers of intervention sessions that are approved by managed care organizations are often limited (Seligman, 1990; Spitz, 1996). Educational or training groups may meet very few times and commonly last the length of an academic semester. This is the crux of the matter. There is a need to make decisions based on a limited amount of information. Decisions made on a limited amount of information are more likely to be in error. This is likely true whether the evaluator uses statistical tests, visual analysis, or some other means. The problem is lack of sufficient information due to a limited number of observations over time, or the presentation of data by limited and aggregated analysis so to provide insufficient detail for effective decision making.

Unique Group Measurement Considerations

There are a number of unique measurement considerations within group work practice. Each consideration will affect the measurement approach used for group analysis (Toseland & Rivas, 1995). Group members may, or may not, have heterogeneity of problems, interests, and background. Members of groups may, or may not, enter the group process at the same time. Groups meet at specified time intervals and measurements of members, subgroups, and the entire group may be recorded on a number of dimensions. The number of total meeting times may vary from group to group, and from member to member. Groups may be difficult to compare to one another due to differences in group composition, leadership, intervention approach used, progression or course over time, frequency of group meetings, and duration of group service offering. Natural or cyclical events occurring in time may affect the responses of one or more group members, or one group as compared to another (Barlow & Herson, 1984). The evaluator needs to determine the utility of evaluative efforts given these problems when rigorous research protocols are not possible in practice or service delivery settings (Hare et al., 1994). Furthermore, there is a need to determine if information can be generated from group evaluative efforts that improve service accountability and reliability (Bloom et al., 1999).

When evaluating group level data there is a possibility in making an error in reasoning when attempting to generalize results and make inferences (Glisson, 1986). These errors, which are known as fallacies, are often due to mistaken assumptions made by the evaluator. Two common fallacies within group evaluation and group research are an ecological fallacy and the exception fallacy (Rubin & Babbie, 2000).

An ecological fallacy occurs when conclusions are drawn about individual group members based on the review of group level data. For instance, a member of the group is presumed to be exceptional in some performance because the group data indicates that the average group performance is exceptional. In reality, the identified group member performs very poorly, but other group members are exceptional and so all members are mistakenly presumed to be performing well (Rubin & Babbie, 2000).

The exception fallacy occurs whenever conclusions about group performance are generalized from one or a few exceptional cases. This phenomenon is common and typical of stereotyping, profiling, or having prejudicial views for a group based on the performance of a few. Inferences are made about the group based on a few exceptional cases (Rubin & Babbie, 2000).

When performing group level evaluation in practice settings, assigning group members to groups randomly may be impractical or simply not possible and therefore internal validity is limited. Furthermore, group members or samples may be selected or identified in agencies or practice settings that are not random with respect to representing a larger population that are known as non-probability samples and limit external validity. That is, the rationale of random assignment cannot be assured within the sample or the evaluative mechanism for the group. However, samples may or may not be representative of the population from which members of the group are drawn. These non-probability sampling approaches are common to practice based settings and are frequently categorized into two groups. Though, random sampling also rarely occurs in between group research a number of research controls such as multiple assessment instruments, or performing partial correlations are used to improve validity.

A practitioner is faced with providing services to clients who seek services. Practitioners would not be expected to have training in the drawing of sample subjects for the purposes of research, but are expected to demonstrate methods of accountability for services provided (Bloom et al., 1999). Therefore, available samples subject to service evaluation are likely to be convenience samples. Convenience sampling is a type of sample in which members of the sample are drawn somewhat accidentally based on their availability. Research samples however, are often purposive samples whereby the researcher is seeking a defined group with specific characteristics that may, or may not, be shared with the general population. The researcher is often interested in answering a specific question of interest with respect to an identified subgroup of the population (Schaeffer et al., 1996). In instances where random samples or probability samples are impractical to obtain, replication from one situation problem or setting to another becomes a powerful basis for the generalizability of results (Bloom et al., 1999; Barlow & Herson, 1984).

“SSD” Statistical Significance Detection

There are a number of difficulties in the detection of statistical significance within single subject designs (SSD’s) using line graphs to interpret and detect change. One of these is the phenomenon of autocorrelation. The term “autocorrelation” refers to the relationship between the outcome or dependent variable scores in single system studies. Outcome scores in single case data are frequently related to other outcome scores when statistical methods are used to draw inferences from the analysis (Marlow, 1998). Differences between single case and group comparison methods of measurement and analysis have led to a number of proposed methods for controlling for autocorrelation. Three methods of attempting to determine whether change has occurred include the use of traditional line graphs such as a celeration line approach, a standard deviation approach, and a relative frequency approach. These methods do not evaluate or manage the phenomenon of autocorrelation. There are two issues concerned with the correlation of group measures over time. These include; the possibility that the observations of individuals over time may be correlated (autocorrelation), and the possibility that an individual in a group may influence other individuals. Both are important (Bloom et al., 1999).

A second approach to the detection of statistical change in single subject designs is by use of a line graph that has included, selecting the midpoints of two values of baseline data and connecting them so that a celeration line is projected into the intervention phase of a study. The direction of the line is in an upward or accelerating trajectory, or downward in a decelerating trajectory that establishes a criterion line for expected or hypothesized change. Depending on the nature of the study, the portion of scores above or below the line may be desirable while those on the opposite side of the line would be considered undesirable. From a proportion of the data on one side of the line, estimates of statistical significance may be determined from series of associated reference tables. The celeration line is not used if the line reaches the minimum or the maximum score possible (Mattaini, 1993; Bloom et al., 1999).

A third, standard deviation approach has been used that analyzes the dispersion of scores from the mean in line graph visualization in an effort to detect statistical change. This celeration line method of analyzing single subject design data has been previously used when there is a trend in the data. The intervention mean is considered statistically significant if it is two standard deviations from the baseline mean. Tolerance or performance limits for respondents may be suggested by the two standard deviation limit. Currently this method uses has been replaced by Statistical Process Control (SPC) charts which attempt to determine whether changes in process mean or score range are within expected tolerance limits for expected change (Bloom et al., 1999, Orme & Cox, 2001).

Then a fourth, a relative frequency approach to the detection of statistical change in single subject designs operates from an assumption that typical behavior or responses are represented by the middle two thirds of baseline behavior or responses. Observations falling outside this area during the intervention phase may be considered as statistically significant for change based on the associated value derived from a calculated probability table. The previously mentioned phenomena of "autocorrelation" can, however, cause difficulties with accurate interpretation. Furthermore, the number of observations in the baseline and intervention phases should be the same (Huitema 1988; Bloom et al., 1999).

<u>Trend Line Inconsistencies</u>

When considering the unique measurement properties of groups, trend-line at different levels of analysis become an issue of some concern. Exception fallacies occur when the observed characteristics of individuals are generalized to the characteristics of their groups. Ecological fallacies occur when the observed characteristics of groups are assumed for group members. Groups may perform well without all group members performing well. Correlations that may be significant at one level of analysis may not be significant at another. For instance, dimensions of interest may be measured and determined to be correlated, but are not correlated when comparing the scores of two group members on the dimensions of interest. Similarly, regression coefficients may be found to be significant at one level of analysis and not at another even in well-controlled group comparison studies where samples are randomly assigned and independence of observations are assured. Regression coefficients may be observed to change direction at one level of analysis and not at another level. In non-random samples trends may be suppressed based on group membership (Glisson, 1986).

Response Shift Bias

Although response bias shift affects individual research and is not unique to group research, the phenomenon is a problem within group evaluation efforts. Evaluating groups by means of pretest and posttest group designs using self-report measures may suffer from measurement error associated with response bias, or response shift bias. Response bias in a self-report measure occurs whenever the participant develops a pattern of responding to all self-report items in a similar way (Bloom et al., 1999). However, there may be a change in the group respondents' understanding of what is being measured between the two measures taken. The change in understanding, or performance, when not due to the intervention is attributed to response shift bias (Robinson & Doueck, 1994). An assumption of pretest and posttest research design is that differences in scores obtained, between the two measurements, is due to the intervention being evaluated. This evaluative strategy is sometimes used in practice to demonstrate treatment effectiveness or accountability through group success evidenced by mean score, or other changes (Bloom et al., 1999). Changes in the internal response of participants between the two measures make the measures difficult to compare and affect the validity of findings and subsequent inferences made (Doueck & Bondanza, 1990). The addition of a control group to the design would not be possible under a number of practice conditions (Anastas, 1999). The self-report instrument given is assumed to be measuring the same dimension without change in metric over the two measurement periods with changes in dependent variable due to the group intervention or process (Robinson & Doueck, 1994).

Changes in cognition, competency, health, problem solving, resources, and a number of other factors, may result in the understanding of the problem, for the group participant, to change over a relatively short duration. Retrospective pretests have been given following the completion of an intervention and compared to the actual pretest to demonstrate the phenomenon of response shift (Robinson & Doueck, 1994). Conclusions or generalizations about changes may be inaccurately inferred due in part to the potential loss of statistical power in self-report pretest and posttest designs (Bray, 1984). Other possible explanations for response shift such as participant bias before the intervention, and the possibility of changes due to social desirability (Rubin & Babbie, 2000; Padgett, 1998) do not adequately account for the change (Robinson & Doueck, 1994).

The administration of a third self-report measurement that requests group participants to reflect back on abilities at the pretest administration given their understanding at the posttest administration period and reevaluate the amount of change experienced from the intervention have been given by group researchers (Robinson & Doueck, 1994). Benefits of this approach using non-parametric testing (Wilcoxin Signed Ranks) suggested that larger effect sizes were likely, and that the possibility of determining that a group intervention was not beneficial when the group may have been beneficial (Type II error) was reduced (Doueck & Bondanza, 1990). However, the circumstances under which response shift bias occurs remains not well understood with traditional group research controls such as random assignment, control groups, and multiple measurement approaches remaining as the best strategies to reduce sources of invalidity of group research findings (Sprangers & Hoogstraten, 1989; Rubin & Babbie, 2000). Regrettably, these controls are not readily applicable to many practice environments. Response shift bias is also not controlled in studies involving the analysis of secondary data.

Exploration versus Confirmation Issues

Statistics used to test hypotheses are for the most part considered a series of analytical techniques that are concerned with confirmatory data analysis. That is, statistical techniques provide controls for a good probability model of approximation, and assess of what we can be relatively sure about the data. However, exploratory data analysis has historically made use of various graphical techniques. In exploratory data analysis, data are presented and evaluated based on determining what questions are suggested by the data and what the data are trying to tell us. Once the questions are identified then confirmatory data analysis is considered (Tukey & Tukey, 1988a). Data visualization refers to a range of graphical representation procedures used with complex data sets that are often augmented by computer technology (Yu & Behrens, 1995a). Computer support is necessary for creating graphics from larger data sets, whereas for smaller data sets handmade images may suffice (Tukey & Tukey, 1988a). The most commonly sited graphical representation method for evaluation of group treatment, as mentioned earlier, is the line graph (Parsonson & Baer, 1992).

Unit of Analysis Issues

There are a number of unit of analysis issues in the literature related to data interpretation. Inferences made at one level of analysis may not translate into reliable inferences at a different level for a number of reasons: (a) limited randomization of subjects or rigidly controlled independence of observations of subjects (Bloom et al., 1999; Orme, 1991), (b) difficulty generalizing characteristics of individuals to characteristics of their groups (Rubin & Babbie, 1997), (c) selection of the group as a focus of intervention effectiveness or the individuals within the group determines the focus for the effectiveness of the group or of the intervention (Toseland & Rivas, 1995), (d) limited empirical research that compares the two modalities of individual and group interventions using the same measures (Hill, 1990), (e) the tendency for intervention research analysis to prefer relatively low within-group variability and relatively high between-group variability (Jayaratne, 1977; Nugent, 1996; Schneider, 1990), and (f) the possibility that correlations or regression coefficients may change direction or be significant at one level of analysis and not at another (Glisson, 1986). This unit of analysis data interpretation issue may be alleviated for the practitioner and agency based decision maker through graphical methods.

Lack of Independence in Groups Non-independence of data may, or may not, occur in groups and affects scores across units of analysis. This problem may occur whether a member is, or is not, randomly assigned to a group (Rubin & Babbie, 2000). Group members dialogue or share information with each other before, during, or after a group. This causes the scores from evaluations to be influenced by one another. However, precautions or special conditions may limit this possibility. For example, groups having virtual meetings over the internet, or training and intervention groups that require assurance from members of no extraneous communication throughout the course of services will likely have limited or no sharing of information. Even with these precautions, the fact that group members interact in some way leaves open the possibility of non-independence in observations (Yalom, 1995). A number of statistical methods have been devised that address measurement problems associated with either the non-independence of observations or scores of group members, or nested levels of measurements within group models having multiple levels of analysis. Analytic techniques that attempt to control for non-independence of observations in group research or evaluation require extensive research training and are not typically utilized at the level of practice or service evaluation. However, one method in particular is useful in sorting different types of problems concerned with independence of observations.

Hierarchical linear modeling. A statistical procedure known as hierarchical linear modeling (HLM) is designed to create precise estimates of the relative strength of relationships between variables which are nested or derived from two or more levels of analysis. This approach permits improved differentiation between error inherent in the research design and random error (Pollack, 1998; Nugent, 1996; Raudenbush, 1988).

Types of Non-independence It is possible to have a lack of independence in groups for two reasons: (a) interaction among people within a group at a given time, and (b) correlation for a particular person or group over time. The technique of HLM addresses both issues, whereas other statistical methods (e.g. ARIMA and other time series models) attempt to resolve the latter.

This method requires mastery of advanced mathematical calculation skills, or research training in complex data analytic software. Skills and training in these advanced statistical analytic techniques are not usually available or practical to those evaluating groups in practice settings. This statistical technique makes assumptions unlikely to be met in practice settings. The trained researcher to provide greater descriptive detail and inferential information of benefit to service settings may analyze practice level information further.

Group Measurement Instruments

Measuring group effectiveness has included the development of a series of instruments devoted to the analysis of group process or outcomes. These instruments attempt to capture the experiences of group members, or some observation of interest to the group leader or evaluator. The constructs of interest vary based on group content or the theoretical perspective of the group evaluator. There are a number of reliable and valid instruments that are designed for more generalized group evaluation. However, the specific instrument must be selected based on the criteria of considered importance to the evaluator or group membership. Instruments attempt to operationalize constructs of interest to be analyzed. Many of these instruments may yield results that may be readily entered into a computerized database for further review and analysis as needed.

Some of these group measurement instruments are designed for specific populations of interest; others are designed to show change in specific situations, or over time. These instruments have been categorized into five areas that include; instruments that provide a screening function for group work, those that evaluate group leader behavior, instruments that assess group climate and/or therapeutic factors, those that provide in session group behavior ratings, and various post group assessments. These instruments have been differentiated by type of group evaluative task that each is designed to address (DeLucia-Waack, 1997).

The first series includes various group screening instruments. These include: (a) Group Therapy Survey (GTS), which assesses members pre-therapy expectations (Slocum, 1997); (b) Elements (Es), which measures dimensions of behavior between people (Shutz, 1992); (c) Hill Interaction Matrix – B (HIM –B), designed to classify interactional styles of perspective group members (Hill, 1965); (d) Group Psychotherapy Evaluation Scale (GPES), which evaluates communication skills and readiness of group members (Kew, 1975); and (e) Group Assessment Form (GAF), which is concerned with the evaluation of social competence of children and adolescents (Lynn, 1994).

The second series are concerned with evaluating the group leader. These group measurement instruments include: (a) Leadership Characteristics Inventory (LCI), which measures leadership styles for counseling/therapy groups (Makuch, 1995); (b) Group Counselor Behavior Rating Form (GCBRF), designed as a group leader behavioral evaluation instrument (Corey & Corey, 1992); (c) Effective Group Leadership instrument, which is used as a group leader training instrument (Tinsley, Roth, & Lease, 1989); and (d) Trainer Behavior Scale (TBS), which serves as a feedback instrument for group leaders (Bolman, 1971; Dies, 1983).

A third series of commonly used group evaluation instruments is concerned with either group climate or the inclusion and utilization of therapeutic factors and their effect on members. These group measurements instruments include: (a) Group Climate Questionnaire – Short Form (GCQ-S), which measures members' perceptions of four dimensions of group climate (Mackenzie 1983; Mackenzie 1990); (b) Group Environment Scale (GES), which measures three dimensions of group environment (Moos, 1986); (c) Therapeutic Factor Scale (TCS), which measures overall presence of Yalom's therapeutic factors across sessions (Butler & Furiman, 1983); (d) Curative Factors Scale – Revised (CFS-R), which measures 12 curative group factors (Stone, Lewis, & Beck, 1994); (e) Critical Incidents Questionnaire (CIQ), which measures perceived importance of events per session (Kivlighan & Goldfine, 1991); and (f) Session

Agenda Questionnaire (SAQ), which measures agenda continuity between sessions (Kivlighan & Jauquet, 1990).

There are also a fourth series of group measurement instruments, which are commonly used for group evaluative purposes and that, are concerned with various in session behavior ratings. The group evaluative instruments include: (a) Interaction Process Analysis (IPA), which measures task, social, and interpersonal behavior (Bales, 1950); (b) System for Multiple Level Observation of Groups (SYMLOG), which organizes group interactions into a three dimensional graphic to examine relationships (Bales, Cohen, & Williams, 1979); (c) Hill Interaction Matrix (HIM), which sorts out group interaction for beginning group workers (Hill, 1965; Hill, 1973); (d) Self-Disclosure and Feedback Behaviors (SDFB), which measures the amount of process involvement over six dimensions of self disclosure for members and leaders (McGuire, Taylor, Broome, Blau, & Abbot, 1986); (e) versions of the Group Sessions Rating Scale (GSRS), designed to assess members and leaders of psycho-educational or counseling groups for different therapeutic interventions (Cooney, Kadden, Litt, & Getter, 1991; Getter, Litt, Kadden, & Cooney, 1992); (f) Group Cohesiveness Scale (GCS), a measurement of group member cohesiveness in working toward a common goal (Budman, Soldz, Denby, Davis, & Merry, 1993); (g) Individual Group Member Group Process Scale (IGIPS), which assesses process dimensions hypothesized to be associated with outcomes in group therapy (Budman et al., 1993); (h) Directives Scale (DRS), which assesses the level of directiveness in group leader requests to group members (Stinchfield & Burlingame, 1991); and (i) Interpersonal Relations Scale checklist (IRScl), which is designed to assess the level of increase in knowledge in managing feelings, thoughts, and behaviors by group members (Shadish, 1984).

A fifth and final series of categorized group measurements is concerned with post group assessments. These group evaluation instruments include: (a) Interpersonal Relations Scale (IRS), which measures the benefit of group participation on interpersonal relations (Shadish, 1984); and (b) Inventory of Interpersonal Problems (IIP), that measures perceived change in group member behaviors related to control and affiliation (Horowitz, Rosenberg, Baer, Ureno, & Vallasenor, 1988).

A number of other methods exist to assess groups and individuals within groups. For instance, one method of evaluating the cohesion level of a group is to track attendance level or participation over time (Bloom et al., 1999). Another group assessment method is to use a general instrument to assess individual satisfaction with the group over a number of dimensions generally associated with satisfaction or cohesion (Reid, 1997). An alternate method referred to as Goal Attainment Scaling (GAS), attempts to measure the level of attainment of goals as established by individuals, groups, or organizations (Flowers & Booarem, 1989; Mintz & Kiesler, 1982). Selection of assessment instruments is dependent on the questions of interest for the evaluator, and limitations imposed on data collection due to time, or organizational constraints and the need to determine evidence of the reliability and validity of the measures.

Graphical Representation

Graphic tools have been used in practice to observe and monitor group process and to facilitate assessment related to member goals beyond the group meeting (Mattaini, 1993). Attempts to represent process have included sociograms (Toseland & Rivas,1995), an elaborate diagrammatic approach (SYMLOG) that summarizes multiple level observations for a single group (Polley et al., 1988), and diagramming approaches that capture process observations rapidly to be shared as feedback in a specific group meeting (Rose, 1989). Graphical approaches to facilitate assessment have included attempts to visualize member's life situations or goals (Toseland & Rivas, 1995), attempts to graphically plan an intervention (Mattaini, 1993), and attempts to monitor individual change within groups (Bloom et al., 1999).

Visual Illustration

Visual analysis of data simply refers to the visual array of one set of information relative to another set of information. Graphical representations or arrays are preferred when at least one set of the information is quantitative. Pictures or diagram arrays are preferred when all of the sets of information are qualitative (Tufte, 1990). There are a number of conventions that have been proposed for interpreting data using graphical representation that emphasize the provision of perceptual clues such as grid marks, surface lighting, and varying texture, color, and orientation (Haber, 1988).

Graphical visualization of individual performance or behavior in the absence of group or community context runs the risk of oversimplification. One measurement instrument may also limit the ability to track progress or verify changes in performance or behavior. Issues which may complicate data visualization include serial dependency (i.e. autocorrelation), inability to accurately depict relative rates of change, distortion of data due to improperly constructed graphs, an increase in Type II errors when observed differences are not large, and the risks associated with subjective interpretation (Mattaini, 1993).

Graphical displays have been useful in group work for displaying or integrating multiple systems in transaction. The complex interactions that occur within groups have been arrayed graphically using a number of techniques to examine progress, process, and outcomes (Mattaini, 1993). Prior visualization attempts of group interactions have attempted to capture the responses of individuals within the group, the overall group, and mediating factors such as the intervention of the group leader. Graphical representations have included attempts to capture both qualitative and quantitative group data. Diagrams and graphical representations have been used to facilitate group members in evaluating the group as a whole and evaluating other members of the group (Moreno, 1937; Moreno & Borgatta, 1951; Polley et al., 1988; Rose, 1989; Toseland & Rivas, 1995).

Graphical Methods Used in Single Subject Designs

Graphical representation approaches in the evaluation of single subject design are often selected based on the number of variables to be represented, or the representation that best conceptualizes the representation of measured variables. Histograms are frequently used to present a visual display of one variable. Median smoothing or mean rendering strategies such as regression lines and scatterplots are frequently used to visualize bi-variate data. Whereas, multiple-variate data are usually represented in social and behavioral research with a series of linear or scatterplot displays, or by use of one or more three dimensional graphics also known as spin-plots (Yu, 1995a).

Methods of representing change or goal maintenance for individuals, groups, and other units of analysis include several widely used graphing diagrams. Single case design line graphs may be illustrated for one, two, or multiple variables, and would include AB single case monitoring designs that graph base-line phases as the A portion and a B or intervention phase of change. Complex phase change diagrams such as BAB designs that depict two intervention phases separated by at least a base-line phase are also used to illustrate change. ABCB designs add a C phase, or placebo, or attention only phase that may also be included as complex phase change designs. Changing criterion designs and alternating treatment designs are other specialized forms of phase change designs. For these line-graphing approaches the difference between each is the number and type of phases of change measured. An alternate approach to line graphing is the concurrent graphing of multiple variables to represent change or maintenance of each variable as a separate representation when the number of variables would not be readily understandable in a single diagram (Mattaini, 1993). Area graphs and surface plots are two methods of providing multi-variate representation.

Line Graphs Line graphs are used to visually represent change over time. The elevation or lowering of a score or aggregate score when compared to the axis representing the dependent variable, or conditional variable is used to represent change from one measurement period or phase to another. Line graphs are extensively used to represent change in single subject designs, time series studies, or to indicate trends or directions and magnitude of change for aggregated measures at discrete measurement intervals (Barlow & Herson, 1984). However, line graphs do not show the degree of variation per measurement interval, and become difficult to interpret after the addition of a few lines to represent additional subjects or units. Traditionally phases such as baseline measurement periods, intervention measurement periods, and post intervention measurement periods are separated by vertical lines to better articulate levels of change (Tripodi, 1994; Mattaini, 1996).

Process Control Charts The use of process control charts in the analysis of single subject group research has not been fully explored. Process control charts, which are common to industrial quality control engineering, and associated with early total quality management efforts in manufacturing, are useful in determining whether a product or observed outcome was within pre-established tolerance limits based on a measure of standard deviation from a static measure of mean or average for the product or observation (Sideridis & Greenwood, 1996; Pfadt & Wheeler, 1995). That is, an outcome may be predicted on observations from prior measurements and may be projected to conform to specified measurable thresholds through a process. For instance, a group of participants could be measured over time across a number of process or performance dimensions under certain conditions. Then, desired outcome scores could be used as an evaluative standard for the group. Group members would perform in the established average or mean range or a number of standard deviations from the expected average. Dimensions could be measured to determine whether the group or members were scoring in the optimal, average, or minimal range of responses based on previous projections (Orme & Cox, 2001).

Scatter Plots Attempts to graphically demonstrate “correlations” or relationships between variables at multiple units of analysis using a traditional scatter plot even with a series of conditional lines illustrated would likely become confusing. Attempts to understand and readily interpret results over a large number of dimensions, conditions, and/or units of analysis would require three or more dimensions. Scatterplots, or scatter diagrams are often used as a two dimensional diagnostic tool to determine if the variance of scores represents a linear or normal distribution of variance in inferential statistics with multiple variables (Black, 1999). Scatterplots may be used for the visual evaluation of variance in groups with respect to the relationship between two variables and for the visual comparison of score variance or distribution for one, two, or a few groups.

Area Graphs Area graphs are composed of multiple bands, or multiple scales that essentially measure multiple factors of change, or closely related dimensions of change. Each band represents one variable and is visually stacked one above another over time so that the context of change is maintained, cases or variables may be readily compared to one another, and the total change is easily interpreted. However, the variables included should make logical sense for the overall analysis of the problem being reviewed. Care should be taken to avoid inclusion of variables that may represent non-related, or poorly related constructs (Mattaini, 1993).

Surface Plots Surface plots illustrate the raw data values along two horizontal axes. Traditionally X and Z serve as the horizontal axes. The data value of the Y-axis then serves to set the height of the vertical axis. The scale or metric used for the data plot then determines the appearance of the shape of the distribution. Larger grids tend to smooth the appearance of the distribution while smaller grids tend to sharpen the angles of the distribution plane (Yu, 1995a).

The three-dimensional scatterplot or surface plot is limited to illustrating only three dimensions when additional variables may be of interest. However, surface plots may be useful in examining three dimensions at a time (Tukey & Tukey, 1988b). Distortions may also occur by representing three dimensions in two-dimensional space. Plotting two variables normally on one axis and then increasing the point size of the third variable may reduce two-dimension visualization distortion. Surface plots may have further limitations in discerning the actual value of a data point. If the number of visually displayed data points becomes too large, the ability to plot a point value for all values would tend to obscure the data analysis (Mattaini, 1993).

Units of Analysis and Graphical Representation

Traditional single case graphical displays that depict baseline and intervention phases are more readily interpreted when the total number of units of analysis is small. Often single case illustrations are used to track the progress of expected change for a single individual or a single group as a unit of analysis. Illustrations using AB and related designs become increasingly difficult to interpret as the total number of cases or units of analysis are plotted, when the number of units of study is large, and as the number of variables increases (Bloom et al., 1999). Often direction and strength of change become more understandable with the inclusion of regression lines or mean averaging approaches of estimating change (Yu, 1995a). Area graphs also have some limitations in displaying a large number of units in a readily understandable way (Mattaini, 1993). Band-width or the aggregation of some units becomes an issue in the use of scatterplots in displaying bivariate data with a large number of cases or units of analysis (Yu, 1995a; Yu, 1995b).

By contrast, three-dimensional surface plots are able to generate a constructed illustration of overall change for a very large number of units of analysis, but through aggregation and limitations of current computerized graphing programs, tend to lose detail and individual performance changes (Mattaini, 1993; Yu, 1995a). Little has been done to date to determine the preferred data visualization approaches for specific types of groups, and types of data collection for differing units of analysis in the behavioral sciences (Yu, 1995a).

Available Technology

During the past decade, personal computers and associated office management software have become widely available. The software programs, such as spreadsheets, intended for business and accounting functions have the capacity to manage and analyze large complex data sets. As these programs have developed, statistical functions have been added along with graphical and charting programs that allow visual inspection and interpretation of data trends. As statistical functions, output tables, and graphical representations are used for the analysis of social or behavioral problems, these applications are likely to gain renewed importance in calculating and imaging data relationship previously associated with costly academic or research statistical programs (Patterson, 2000a).

Spreadsheet Applications Computer spreadsheet programs and applications have been a largely neglected tool for the evaluation of social work practice and practice based social work research. For the last generation there has been a movement toward greater accountability in social work practice settings. Accountability standards have been recommended for purposes of determining intervention effectiveness, reducing risk of harm to clients, providing cost effectiveness information on services provided, and for tracking overall program progress at various levels in human service agencies. Spreadsheet technology provides a ready instrument for accomplishing many of these tasks and may be rapidly mastered by service providers with minimal training.

Spreadsheets can be used to perform the data collection, data recording, data storage, the scoring of measurements, data analysis including statistical analysis, graphing, and graphical representation tasks of research and evaluation. Spreadsheet programs are widely available. Computer spreadsheet programs such as Microsoft Excel and Lotus 1-2-3 are commercial versions of spreadsheet applications in wide distribution among personal computer owners including social service agencies and practicing social workers. These available technologies may be used to accomplish much of practice based evaluation and practice oriented research without the need to acquire sophisticated and expensive statistical analysis packages such as SPSS (Statistical Program for the Social Sciences) and SAS (Statistical Analysis Software) used most often by research scholars in academic or government facilities.

Personal computers and spreadsheet programs have become widely available over the past decade. Most human service agencies have a number of available personal or networked computers capable of running spreadsheet applications on their operating systems. Training in basic spreadsheet functions is available from computer equipment distributors; private training programs, most universities and colleges, and in a number of online formats including distance education, computer disks, and web based tutoring programs. Recent texts have also become available that include step by step guides to solving accounting, statistical, and documentation problems using spreadsheets.

Patterson (2000a) offers a current and detailed examination of spreadsheet technology for a variety of practice evaluation and basic research problems in human services and for social work practitioners. Spreadsheets may be used to collect data from observations, or survey instruments. Scores can then be statistically analyzed and readily be selected and placed into flexible pivot tables that allow aggregated measures to be rapidly calculated across a number of variables. Graphical representations may be quickly displayed permitting social work practitioners to have a means to readily interpret outcomes and modify interventions. Practitioners may follow a cookbook routine that permits rapid replication of the analysis method across similar service domains. Tedious data collection, calculation, or graphing routines may be preformatted and reproduced to provide efficient training and service routines. Online demonstration examples of step-by-step training for common spreadsheet applications using single subject evaluation designs and other common statistical analysis procedures are already available (Patterson, 2000b).

Computer Assisted Instruction Computer assisted instruction, which had formerly been thought of as an instrument for use by educational institutions has begun to make the transition to service and other primary service organizations. This mode of transmission of training has begun to replace in part, the traditional oral training or workshop mode of passing on organizational knowledge (Flynn, 1990). Although initially computer assisted training focused on illustration of visual flowcharting of organizational processes, spreadsheet technology has facilitated the expanded use of computer technology by the front line practitioner in the evaluation of service effectiveness (Flynn, 1990; Jantzen & Lewis, 1990). Spreadsheets designed to perform accounting functions, have the capacity to manipulate numbers in human service settings. Models of problems can then be developed and articulated through the use of tables and charts of the associated spreadsheet program. Spreadsheets also permit the development of projections at various levels of service (Jantzen & Lewis 1990; Lohmann, 1987).

Computer spreadsheet applications may be learned fairly quickly, especially if there is a routine process of data collection and analysis needed for a specified practice, or agency environment. Many computer application users become proficient in repetitive problem solving by first becoming familiar with the computer hardware and software where tasks are to be completed, watching a demonstration of the task to be performed, problem solving using a task specific set of demonstrations, and finally problem solving with the assistance of an instructional manual (Kerr & Payne, 1994). Advantages of this learning by watching and doing approach include rapid assimilation of repetitive skills, but disadvantages may include limited understanding or interpretation issues when unusual circumstances arise involving spreadsheet technology (Hendry & Green, 1994).

Therefore, the use of recently available interactive tutoring applications, or hypertext guides serve as a review of process and alternative methods of problem solving for the casual spreadsheet user. Demonstrations and skill sets may be reviewed and rehearsed in the absence of a live trainer at the discretion of the service provider. Thus the relative strengths and advantages of spreadsheet technology in the service environment can be maximized while reducing weaknesses and disadvantages (Lentini, Nardi, & Simonetta, 2000; Patterson, 2000b).

Commercial Software for Data Visualization A number of advances in personal computing power over the past few years permit advanced data analytic functions to be performed in practice-based settings. These programs allow for the importation and exportation of data files to enable file sharing with traditional academic based research software such as SPSS or SAS. Most of these personal computer based software data analysis programs rely on the power and flexibility of spreadsheets. Equations and data calculation functions can be customized and then developed as a template for ease of replication (Dretzke & Heilman, 1998). Spreadsheet software is being further transformed by advances in graphical representation technology. Spreadsheet based decision models are widely used in business and are a transferable technology for other service evaluation needs (Mather, 1999). Microsoft Excel, Quatro Pro, and Lotus 123 are spreadsheet programs that are now widely available on most modern personal computers (Black, 1999; Patterson, 2000a). The statistical analysis tools in spreadsheets have an extensive range of options that include functions for simple descriptive statistics such as means and standard deviations to functions to perform complex multivariate analysis (Dretzke & Heilman, 1998).

The emergence of data visualization and graphical representation software programs show promise of managing the complexities of multilevel group evaluation procedures common to agency decision makers. Data visualization has evolved into a methodology for data exploration, outcome evaluation, and representation of multilevel group data. Advances in personal computer development, have generated increasing interest in applying the improved ability of computers to collect, store, and process large data sets to the graphical representation of information (Yu & Behrens, 1995). Data visualization procedures often transform large, multivariate data sets into images of the phenomena measured. Graphics generated in data visualization software offer a means to explore and contribute to the understanding of multivariate data sets (Dretzke & Heilman, 1998). Therefore, the intended audience and the graphics creator are able to share a common understanding of the data based image (Henry, 1998).

Implications for Social Work Practice

Group work has been an integral part of social work since the inception of the profession. Both the community organization and professional sectors of the profession have utilized groups and group interventions to advance social welfare policy and advance the human condition. During periods of scarce resources group work has been an essential method of service delivery. Recent gains in science and technology have permitted social workers to differentiate between effective and non-effective group work and interventions, and to validate the effectiveness of appropriate group strategies. These technologies have also allowed the tracking of multiple variables, which affect individuals and populations.

Advances in technology are now making sophisticated research tools available to most social workers to evaluate their effectiveness with groups and to track progress for both individuals within groups, and organizations. Statistical and graphing capabilities will permit conscientious social workers to add to the knowledge base of the profession and discriminate between the utility of different group delivery, intervention, and analysis methodologies. The capacity to provide the best fit of services to complement both individual needs and best group outcomes in many instances is now within the realm of possibility.

Data visualization using now available personal computer technology shows promise in providing the tools necessary to meet the demands of group evaluation in practice settings. Evaluative methods that take into consideration the unique measurement properties of groups can be developed using existing or developed instruments to advance single subject designs and to graphically represent a number of units of analysis. The development of data visualized group evaluation case examples and related training materials can be expected to contribute to improvements in services and decision making capacities of service providers, supervisors, administrators, and policy makers in various practitioner based settings. The focus on data exploration at the level of service may be expected to produce additional observations that will serve to advance practice-based theory and research interests over time.

Research Questions

Therefore, research questions and related hypotheses can be generated to examine a number of issues generated from the literature review within this current study. These would include:

1. Can graphical representations of group level data be constructed using widely available technology to visually depict group process and outcome simultaneously and to demonstrate change across units of analysis such as individuals, groups, dimensions of change, multiple leaders, and multiple groups, and over time?
2. If complex group level data can be visually represented so that change across multiple units of analysis are possible, then what are the measurement or other limitations to the utility of the (these) graphical representations in the evaluation of group therapy experiential education outcomes?
3. What guidelines or rules should be considered in the interpretation or utilization of these data visualization procedures?

Hypotheses

The primary focus of this study is the methodological demonstration and evaluation of data visualization through the use of several graphical representations of group therapy experiential education outcomes. Therefore, the nature of the hypotheses stated and as related to graphical representation, would address whether a particular graphical representation would meet the evaluative needs of group level time series data. Furthermore, that the produced and demonstrated graphical representation(s) has(have) the capacity to image data across a number of dimensions with non-probability samples so as to provide meaningful information about data trends or outcomes for a particular evaluative issue. That is:

1. A three-dimensional surface plot is expected to image time series data on at least three axes of measurement, one of which is time.

2. A scatter-plot will demonstrate or graphically represent the distribution of data values so as to draw some conclusions about the relationship between two variables.

3. An area graph will demonstrate the upper bound threshold of a measured series of scores and could be compared in the same time series with other similarly measured scores.

4. A line graph is expected to demonstrate the measures of a few subjects or aggregated group scores over time.

A primary hypothesis set forth in this study then, is that the graphics presented demonstrate visual inspection qualities that contribute to the evaluation of single subject design group interventions as follows:

1. Line graphs that that exhibit tolerance thresholds across time or moving with specific time measurements are hypothesized to provide an evaluative capacity not realized in traditional line graphs associated with single subject designs evaluating change in individual interventions.

2. Area graphs are also hypothesized to have the capacity to be utilized so as to provide evaluative information about the proportional contribution of multiple dimensions of change over time.

3. Three-dimensional surface plots through the capacity of a third graphical axis of the scale will provide information on more than one level or analysis simultaneously. Therefore, they are hypothesized as having the visual capacity of representing process and outcome indicators for groups simultaneously as are the graphical representation demonstrated by area graphs.

4. The imaging of replications of multiple group processes or outcomes is hypothesized to be possible with three-dimensional surface plots.

5. Furthermore, the above graphical representations are made possible with the assistance of spreadsheet applications.

However, these hypotheses do not address the limitations of group evaluation through graphical representation when sampling and design issues compromise the statistical conclusion validity of time series group level data. Therefore, a series of data analytic hypotheses are proposed as related to the expected results and measurement limitations of the data included in this study secondary to limited research controls. These assumptions are related to the general linear model and are only relevant in deciding how to analyze data.

Hypotheses related to each measurement limitation question are listed here as follows:

H1: Group participant scores will NOT be normally distributed in single groups or in all groups combined.

H2: Group participant scores will NOT be distributed so as to meet the assumption of linearity in individual groups or in all groups combined.

H3: Group participant scores will NOT be independent in individual groups or in all groups combined.

H4: Group participant scores will NOT exhibit heterogeneity of variance in distribution.

H5: Autocorrelation of time series values will occur in each group such that group change as measured by the aggregate dimension of group satisfaction will NOT be statistically significant when tested in a SINGWIN application (described below).

H6: The autoregression term for all time series values will be significant across all groups' data for each dimension of change tested in an SPSS application (Note: autoregression is the same as the autocorrelation procedure except that it serves to confirm that later scores may be regressed on preceding values and will serve as additional confirmation of autocorrelation here) .

Chapter III:

METHODS

Purpose of the Study

The purpose of this study is to evaluate group therapy experiential education outcomes using conventional data analytic methods for time series data and widely available methods for the visual representation and evaluation of group level time series data. These include traditional methods of visual evaluation of single subject information, as well as, less common graphical representation methods that permit the simultaneous display of group process and outcomes and provide visual evaluation information across units of analysis. For example, a non-traditional graphical representation method that permits the simultaneous evaluation of multiple groups of time series observations will be included.

The purpose of this study also includes the demonstration of the appropriate rules of graphing, and the provision of conventions or guidelines necessary for the interpreter to assure that appropriate conclusions may be drawn from data. This accountability effort includes addressing the potential for the manipulation of visual images (graphical representations) by incorporating tables of statistical results in conjunction with the displayed graphic. Associated descriptive and inferential statistics will be reported where possible. The reporting method is expected to assure that the trained researcher will be able to evaluate the accuracy of the graphic (Monette, Sullivan, & Dejong, 1990; Mattaini, 1993).

Methodological Review of the Literature

What follows is a brief methodological focused review of the literature, or as the literature relates to and is concerned with the proposed methods of this study. This is done to familiarize the reader, or reviewer, with the available literature relative to methods selected for the study. This literature review for study methodology is divided into three sections. First, literature on the problem area addresses the decades long attempt to develop practice accountability methods using single subject design and the difficulties encountered in evaluating group designs is reviewed. Secondly, literature in the area of theory is concerned with attempts to use graphical representation in the evaluation of single subject design with group level services. Then thirdly, literature on methodology is concerned with the methodological difficulties encountered when attempting to evaluate time series group level observations. Each of these three areas will now be briefly reviewed.

Literature on Problem Area

As stated earlier, group services and interventions have been an integral part of the development and history of social work (Reid, 1997). The demand for group services is increasing in part due to the need to offer more efficient services related to healthcare and behavioral healthcare cost containment efforts (Spitz, 1996). Group interventions have also become a mainstay of service modality in a number of publicly offered services. These include public health services (Van Elderen, Maes, Seegers, & Kragten, 1994) and public or community mental health services (Scheidlinger, 1999; Young, 2000). Furthermore, group services have been proposed internationally to address public health concerns on the larger scale of at risk populations (Rodriguez, 2001).

For more than the past three decades, single subject design has been promoted as the preferred methodology to evaluate services in practice settings (Thyer & Thyer, 1992). Practitioners have been urged to develop service accountability for all modalities of direct service (Bloom, Fischer, & Orme, 1999). Yet, little work has been specifically focused on the development of an evaluative methodology for group level services provided in practice based or agency based service environments (Tolman & Molidor, 1994).

The traditional method in social work of evaluating single subjects in practice settings through the use of single subject designs has involved the plotting of scores or measurements at intervals of time to include baseline, intervention, and maintenance phases of treatment which, are then plotted, or analyzed and plotted, on a conventional line graph to visually evaluate change (Tripodi, 1995). However, this approach is limited in ability to evaluate multiple levels of change and for more than one unit of analysis. Ecological fallacies can occur when attempting to make inferences at more than one level of analysis. For instance, mean and trend lines, or regression coefficients may be inversely correlated depending on the level of analysis inferences are to be made from, or even as a result of, group membership (Glisson, 1986). Therefore, a need exists to develop a single subject design methodology for the evaluation of group level interventions that takes into consideration the complexities of representing multiple levels of change over time.

Literature on Theory

There are a number of graphical representation methods for visualizing patterns of change related to intervention efforts over time and for various units of analysis including group level change. However, many are components of research level data analysis application programs, such as SAS and SPSS that are not currently widely available at the level of service delivery. Emergent technology may offer the potential to develop practitioner friendly and widely available group evaluation tools for many aspects of the human services delivery system (Schoech, 1993). Graphical representation may be a preferred method of rapidly transforming data patterns into visualizations that augment decision-making at the level of service (Mattaini, 1993). Yet, care must be taken to understand the limitations in the interpretation and analysis of data presented in graphical format. Graphics require careful structuring to convey meaningful and understandable information to the user (Wilde & Lewis, 1990).

For instance, surface plots may be employed in the graphical representation of multiple dimensions of group process evaluations or group participants individual evaluative responses measured across the duration of their group experience. This method affords group practitioners, supervisors, and administrators improved options for simultaneously evaluating and comparing individual or discrete group process dimensions and overall group change over time. This data visualization method does not require specialized computer software, but instead utilizes commonly available spreadsheet software in the collection, summarization, and graphical representation of evaluation data (Patterson, in press).

There is a learning curve associated with the interpretation of three-dimensional graphic representations (Farrell, 1987). Initially, interpretation of surface plots may challenge viewers to comprehend the informational content inherent in the representation. A number of rules have been proposed for interpreting data using three-dimensional or volumetric techniques that emphasize providing perceptual clues such as grid marks, surface lighting, and varying texture, color, and orientation (Haber, 1988; Tukey, 1988; Tufte, 1983).

Therefore, it is important to understand the limitations of the data collection and analysis methods involved for the data to be evaluated in a particular instance. Furthermore, a determination may be made as to whether data analysis results should accompany a particular graphical representation to assure appropriate practice level, or agency level, decision-making. That a graphical representation may lead to false conclusions where limited data collection methods have been employed is hardly surprising. However, this does not limit the utilization of the graphical representation to visualize data, in ways that impart new levels of understanding, especially where adequate precautions have been taken to assure reliable and valid data collection methods. Furthermore, conventions for the interpretation and dissemination of graphical representations necessary for competent evaluation of results need to be articulated and conveyed, so that uses and limitations of information provided by the graphic are understood by the evaluator. This determination of limitations to data analysis within the context of the specific data being evaluated, and the expression of the guidelines relative to the display and interpretation of graphically represented results are relevant to the methods of this study in that these conventions point out the appropriate use and limitations of the graphic demonstrated.

Literature on Methodology

Statistical conclusion validity in single subject designs, including time series designs, and group level designs, remains problematic for a number of reasons. Simply stated, statistical conclusion validity is concerned with whether a relationship exists between an intervention and an outcome. As mentioned earlier, correct statistical inferences are difficult to obtain in the evaluation of time series data, or with non-probability sampling due to the increased possibility of Type I or Type II errors. These errors are possible even though the task of time series evaluation is understood to be that of making prediction or forecasting. According to Box, Jenkins, & Reinsel, (1994) there are two main goals of time series analysis: (a) the goal of attempting to identify the nature of the phenomenon represented by the sequence of observations, and (b) and the goal of evaluating the potential of the data to forecast (predict future values of the time series variable). It is assumed that the data consist of a systematic pattern (often a set of specified components or dimensions of observed change) and random noise (or unobserved error), which usually makes the pattern difficult to identify. Time series data analysis techniques involve some form of filtering out noise in order to make the pattern identifiable and representative of actual change.

In the context of the evaluation of services, the purpose of time series analysis is to determine if change occurred over time and if so, to determine if possible why the change occurred. Graphical techniques have been used to aid in this determination. Graphical representation approaches to time series analysis in single subject designs have usually aggregated observations to produce a trend or line graph to represent the direction of change for a component or dimension of interest (Bloom et al., 1999). The emphasis of this study then, is to demonstrate graphical representation methods in the evaluation of group therapy experiential education outcomes. However, the limitation of inferences possible from data collected under non-research conditions is also being addressed.

Dependence of observations or scores is thought to occur in time series data collection and analysis. This dependence refers to serial dependence and may affect graphical attempts to represent the data. That is, this serial dependence may create a correlation of observations of one variable at one point in time with observations of the same variable at prior time points. This dependency is often referred to as autocorrelation. The serial correlation of error terms for estimates of a time series variable provides the foundation for the dependency. This results from the possibility that the value of an observation at one time measurement in a series is dependent on the value of that observation at the preceding measurement time (lag -1) or some other previous measurement (a higher lag -2 or above) (Brockwell & Davis, 1991). Therefore, graphical representation strategies may include time series data or score values that have been transformed to eliminate autocorrelation to where possible. Graphical representations may also be constructed from analyzed data that attenuate potential error terms. Additionally, graphical representations may be presented with accompanying data or data analysis results, so that limitations of the graphic may be further evaluated prior to conclusions being drawn from the graphic.

There are several limitations in attempting to forecast future outcomes with time series data related to violations of statistical assumptions when data collection occurs under less than stringent research protocols. These limitations in prediction provide ample cause to consider limiting investigation of data patterns to data description, data exploration, or data evaluation under non-research conditions. These conditions occur frequently, whenever there is repeated measurement of the same persons over time. The limitations to statistical inference provide a rationale for considering the alternative of variable analysis through data visualization using computer application spreadsheets as an option for accomplishing graphical representation tasks.

Time series experiments are often modeled through the use of line charts or linear graphics that attempt to project, or predict, change over time. However, violations of linearity, or the assumption of a linear relationship between two variables is considered serious. Extrapolations, or predictions, beyond the range of the sample data are likely to contain serious error. Graphical illustrations of data distribution such as scatter-plots, or observed versus predicted values, or a plot of residuals versus predicted values will likely reveal these violations. Data points should be symmetrically distributed around a diagonal line in the former plot, or a horizontal line in the latter plot. Observation of a "bowed" pattern in a distribution indicates that the model will make systematic errors whenever it is making unusually large or small predictions (Norušis, 2000; Pedhazur, 1999).

Non-independence of observations also creates a problem in the statistical analysis of group level, time series, or nested data observations. For instance, individuals who are drawn from an institution, such as a classroom, a practice group, an agency, a business, or institution, will likely be more homogeneous than if individuals were randomly sampled from a larger population. Because these individuals tend to share certain common characteristics, observations based on these individuals are not fully independent. However, independence of observations is a primary assumption of parametric or multivariate statistical analysis and numerous other statistical or inferential data analytic procedures. This assumption of independence is violated in the presence of hierarchical or nested levels of observations (Bryk & Raudenbusch, 1992). As a result, attempts to make predictive inferences through ordinary least squares regression is undermined as nested observations produce small standard errors (Pedhazur, 1999). These errors can inflate Type I or Type II errors depending on the nature of the correlation. Furthermore, many non-parametric procedures also assume independence, such that non-parametric analysis does not resolve the limitation. Therefore, these errors lead to a high probability of rejection of a null hypothesis, or a high probability of rejecting a valid alternate hypothesis. Alternatives are to limit the inferences made, to modify the research design to assure independence, or to consider an alternate analysis of the observations (Bryk & Raudenbusch, 1992).

Violations of the assumption of normality, or normal population distribution of data values, also frequently occur in time series analysis. This violation of normality often arises either because (a) the distributions of the dependent and/or independent variables are themselves significantly non-normal, and/or (b) the linearity assumption is violated. Non-normality of the distribution of values may be detected through excessive skewness of the variable values or Kurtosis of the data distribution or through a normal probability plot of the residuals (Norušis, 2000; Pedhazur, 1997).

Attempts to understand possible trends in data from a time series analysis has involved any number of methods to address modeling of mathematical strategies to reliably forecast future values. In practice oriented research and evaluation, the patterns of the data are often difficult to discover. Individual observations involve considerable error, complicating the need to identify the hidden patterns in the data but also produce reliable forecasts. An auto regressive integrated mean averaging approach (ARIMA) has become an accepted means of exponentially smoothing exaggerated trends in time series data and attenuating inflation of scores due to unobserved error when other violations are controlled for. This method requires a larger number of observations than are normally available in practice settings. This method also involves a level of statistical complexity that few practitioners are prepared to handle. Therefore, smoothing of trends in time series data may leave some uncertainty about statistical conclusions drawn when other assumptions are not met. (Weigend & Gershenfeld, 1994).

Sampling Protocol

The study employs non-probability sampling and relies on available subjects. A major strength of the study however, is that the study is replicated over 16 iterations of group samples, across time, and across group leaders. Results if replicated with respect to positive change of group participants provide the bases for evaluating change even though generalization is limited due to the lack of available demographics for the sample participants other than in aggregated form. As the surveyed subjects did not complete individualized socio-demographic profiles at the time of survey, only aggregate descriptors of the sample are possible. These are known and are described below.

Subjects in this study are 247 second-year social work graduate students participating in 16 experiential, group psychotherapy training groups that were conducted over the course of several academic semesters between 1997 and 2001. Initially, instructors had collected the survey data as a weekly class group evaluation educational activity without intention to be used for a research study. The portion of the data collected prior to summer of 2000 is considered pre-existing data. However, data collected after being considered for this research effort that began after April 11, 2000 was subject to, and approved by, an internal review committee of The University of

Tennessee (IRB # 0334). These subjects completed 2,398 surveys during the observation period for the collection of all of the group's data. During this time frame three additional course sections were offered that will not be included in the study due to use of a different version of the survey instrument in two groups and the course leader deviating from the data collection protocol in the third group. All subjects are residents of the United States with the majority of 84.54% being residents of the State of Tennessee. Most subjects are European-American comprising 91.16% of the sample, with some African-American students comprising 4.97% of the sample, and with a smaller representation of 3.97% for all other ethnic profiles. Females comprise the majority of students 85.63%, with an average age of 31.52 years for females. This may be compared to male students who comprise 14.36% of the sample with an average age of 34.15 years. All members of the sample report previous paid or volunteer work experience.

Group sessions lasted from one hour to an hour and a half and occurred on a weekly basis with the exception of holidays and vacations regulated by the university calendar. Subjects were students who took part in the group intervention training as part of their clinical education within group treatment. Informed consent was obtained from students who were to voluntarily participate or decline to participate. Each week at the end of group, subjects completed an instrument, described below, on which they rated their satisfaction across eight dimensions of their personal and group experience. The data were initially collected as a part of the education of students regarding evaluation of practice procedures, and as a means of providing an evaluation of several dimensions of experiential group satisfaction on an ongoing basis. Over the duration of all groups, there was almost universal participation in the group process and response to surveys among subjects.

Design

The study evaluates time series group data. The data in time series studies include sequences of measurements that are ordered over time. In this instance the data were also collected from a non-random sample. Unlike the analyses of random samples of observations that are discussed in the context of most other statistics, the analysis of time series is based on the assumption that successive values in the data file represent consecutive measurements taken at relatively equally spaced time intervals. A multiple replication of the time series design will be utilized to visually evaluate and graphically represent any reoccurring trends across multiple groups (Rubin & Babbie, 2000).

Data Collection

Data were collected from subjects in the sample from the fall semester of 1997 through the fall semester of 2001. Collection of the data occurred over a four and a half year period. All surveys were completed and compiled into a Microsoft Access database during this time frame. Data cleaning was completed in early February of 2002. Data were queried by subject, dimension of change, group, or session, interval of time, or by multiple groups as needed for data analysis. Data were transformed into the format needed for each data analytic application, or have been reentered into applications as needed.

Measurement Instrument

The measurement instrument to be used in this study is a modified form of the recent Reid's Evaluation of Today's Group Session (Reid, 1997). The instrument has not been used previously within group research. There are no available published reliability and validity estimates for this instrument. In Reid's original instrument group members rated their satisfaction with the group on a Likert scale of 1 to 5 (1 = Very satisfied, 2 = Satisfied, 3 = No feeling one way or another, 4 = Dissatisfied, 5 = Very dissatisfied). Three modifications have been made to Reid's original instrument. First, to capture greater variability in responses, the Likert scale range has been expanded to 1 to 9. Second, the scale direction is reversed with 1 = Very dissatisfied, 5 = No feeling one way or another, and 9 – Very satisfied. Third, an additional item has been added. The current instrument version provides a definition of group cohesion and group members rate their level of satisfaction with degree of cohesion in the group (Patterson, & Basham, 2002).

The modified instrument used for this study contains eight items that group members rate (from 1 to 9) their level of satisfaction with: (a) the amount of time I had to share my personal issues, (b) the leader's involvement in the group, (c) the comfort of the room, (d) the trust level in the group, (e) the other members' respect for each other, (f) the respondents sense of honesty during the group, (g) the degree of sharing that goes on in the group, and (h) the level of cohesion in the group. Each of the instrument's items represents a dimension of evaluated group process and may be represented in the data visualization procedures.

Psychometrics

The reliability and validity of Reid's Evaluation of Today's Group Session (Reid, 1997) as modified by Patterson (in press) has not been established through previous studies. As additional scales were not administered with Reid's modified scale, validity cannot be confirmed through cross validation correlations with instruments measuring similar constructs. Instrument reliability (*r*) was calculated with a coefficient alpha for the current administration of the instrument, which may be compared in subsequent administrations (Crocker & Algina, 1986). Internal instrument consistency and construct validity will be further evaluated through exploratory factor analysis and data reduction methods. Principal axis analysis may be considered, as the sampling distribution is unknown (Kline, 1994). However, observations may not be assumed to be independent in time series data and the distribution of scores may not be normal. Measurement violations of these assumptions would limit the inferences possible concerning the variance attributable to factors extracted. Though a practitioner would likely have little need to assess the internal instrument consistency and construct validity, instruments referred to practice settings by research scientists for decision making purposes should be referred following evaluation through advanced statistical methods to determine their limitations.

Data Analysis

Data analysis methods were used to explore observed data parameters. Selected methods were used to establish the limitations to the utilization of time series group level data, collected without a probability sampling procedure, in this study. This type of data is similar to those data features likely to be derived from practice based, rather than research based, practice evaluation efforts. Data visualization through graphical representation remains the focal area of this study. Additionally, observations are limited to those recorded on a single scale designed to survey dimensions of a single construct, and are expected to have limited external validity. Limitations, or principles, of interpretation of graphics will be identified based on prior available research in the literature, or as observed, in the graphical representation as demonstrated.

The data explored in this study were entered into a Microsoft Access database program and queried and converted to Excel spreadsheets and subsequently into multiple page Excel workbooks for purposes of representing data visually and performing descriptive statistics. Data for each group were summarized using Excel Pivot Tables, a data analysis tool for creating cross-tabulation tables. Once the cross-tabulation tables are produced, the next step was to select the data in the cross-tabulation table and then employing the Excel Chart Wizard tool to specify the type and configuration of the various graphical representations to evaluate the data (Dretzke & Heilman, 1998).

Data in this study was converted to an SPSS database for performing of statistical analysis functions that are not currently included as pre-formatted data analysis functions in Microsoft Excel computer applications (Norušis, 2000). These analyses may not be of practical utility for non-research trained personnel and for agency based evaluation purposes, but are included to answer additional questions of interest specific to exploratory research. Though several add-on packages are available for Microsoft Excel that may duplicate these functions, they are generally not yet widely available in the practice setting.

Additionally, as autocorrelation is a common analysis issue in time series data collection, data for each group is imported from Microsoft Excel into SINGWIN. The SINGWIN application is designed to use a single subject spreadsheet application to evaluate single subject data for individuals or small groups. The current version has the capacity to evaluate autocorrelation for a limited number of observations (Auerbach, Schnall, & Laporte, 1999) This application was selected to demonstrate that appropriate analysis of auto-correlated error. Autocorrelation is common to time series data and is an important methodological consideration in the evaluation of observations over time. The SINGWIN application is designed to evaluate autocorrelation when group size is small or there are a smaller number of observations. Furthermore, where indicated, aggregated group level data were also evaluated through statistical process control charts in an add-in Excel template that demonstrates an aggregated line graph approach to quality control within a single subject design (Orme & Cox, 2001).

Graphical Analysis

Graphical representations generated with Excel spreadsheet models and templates to include pivot table functions were illustrated. These representations were selected in order to demonstrate how the standard line graph, standard deviation enhanced line graphs (Patterson & Basham, in press), area graphs, and three-dimensional surface-plots are used to evaluate each group across weeks of times of measurement. Graphical representations at the levels of individuals within the group, and the level of dimensions of change over time of within each group were demonstrated. Then, graphical representation of multiple groups, or all groups in the study, was visually displayed at the level of dimensions of change for all groups, leaders of all groups, and for the time series of all groups combined. In the case of the display of three-dimensional surface plots, an inconsistency in the orientation of the graphical representation was chosen in order to provide the best visible display of graphed data. The dimension of time may be oriented to the right or left side of the graphical image. While it is recognized that this technique is a non-standard method of image representation, the decision was made to represent data in a way that provided the observer with the greatest perceptual orientation to detect change visually. All other scale variables were produced as consistently as possible. The data visualization for line graphs and area graphs were not produced however, when the number of individuals, exceeded ten (this occurred in all groups), due to the known difficulty deriving meaning from line graphs and area graphs with too many layers of data (Tufte, 1983).

Graphical evaluation in SPSS was limited to the generation of graphical representations necessary to evaluate the statistical tests involved in data analysis, or as needed to examine violation of assumptions needed to perform a predictive statistical analysis. An exception is possible if the data reveals a pattern whereby an SPSS graphical representation provides a preferred visualization of the data when compared to more widely available computer applications utilized in this study. Although SPSS has the capacity to generate a variety of statistical process control charts, this means of graphical generation would likely not be available to practitioners, and therefore graphical representations from an Excel add-on application were demonstrated.

Graphical evaluation in SINGWIN was limited to graphical representations of single groups due to application design limitations. First time measures were entered as baseline scores to be compared with later time of measurement scores, which were entered as intervention scores. Establishing a baseline from first time measures permitted an evaluation of the initial data prior to the phenomenon of autocorrelation occurring from observations over time. As the autocorrelation for each group was evaluated in SINGWIN (Auerbach et al., 1999) a moving average line of the graphical representation of the intervention phase of group measurements has been demonstrated. The moving average line was selected to provide a comparison between initial intervention score values and to demonstrate a moving average smoothing of the initial values selected to compensate for auto-correlated error and provide an attenuated representation of intervention change less affected by autocorrelation.

Graphical evaluation in SPC Charts (Orme & Cox, 2001), the Excel add-on template application, is limited to graphical representations that are formatted to evaluate group level change and that are designed to evaluate consistency as a form of quality control and tolerance thresholds of acceptable variance. Two graphical representational formats met this challenge. These were the X- Bar –R chart, and the R-chart.

The first of these, the X- Bar –R chart calculates the average score for the time measured. Then, the X- Bar –R chart creates a mean of average scores to identify average quality without variance. Thereafter, the X- Bar –R chart uses the upper bound and lower bound confidence level as tolerance levels of acceptable variance for score averages per time measured.

The second of these, the R-chart calculates the average of the range of scores. Then, the R-Chart creates upper bound and lower bound confidence intervals to establish tolerance levels of acceptable variance of score range. However, a limitation of this Excel template for the R-chart, is that it is necessary to change the Excel formulas for the UCL (Upper Confidence Limit) and LCL (Lower Confidence Limit) lines for each group evaluated to reflect the number of scores per time period. The SINGWIN application mentioned earlier does not have this problem and provides an alternate method of visually evaluating the range of score values over time without this limitation.

All graphical representations are described based on: (a) content, or results visually represented, (b) the utility and limitations of the graphic to provide information to practitioners or agency based service providers to make decisions, (c) the need to have accompanying statistical or numerical information to augment the graphic, and (d) an interpretation of graphical results along with suggested rules for best utilization of the graph or representation. Where feasible, the graphic has been described or linked with other statistical results for continuity of this project.

Statistical Analysis

Statistical data analysis consists of the following procedures. Data were queried from the Microsoft Access database for individual subjects, by each group separately, by dimension of change, and for all groups. These were then imported or entered into other data analysis and graphical representation programs for further evaluation. Frequency distributions and descriptive statistics were also computed to identify any data entry errors. A missing values analysis was performed to determine the rate of missing values and overall group participation. A method of analysis consistent with a high or low number of missing values was then chosen so as to enter values so that further statistical and graphical analysis could be performed. In this study, as the missing values were less than 1%, mean substitution for missing values was used. Descriptive statistics were then analyzed to determine the distribution of values and equivalence of variance for group level variables. Non-normality of the distribution of values was evaluated through observation of excessive skewness of the variable values, and kurtosis of the data distribution, and through a normal probability plot of the residuals.

Normality of distribution of values was evaluated through the construction of a histogram for each group and all groups combined and confirmed through computing the kurtosis and skewness of the data distribution for each group and all groups combined. Non-linearity was evaluated through observation of scatter-plots, or observed versus predicted values, or a plot of residuals versus predicted values. Non-independence of values can be confirmed through tests of autocorrelation in SINGWIN. Non-equivalence of variance or non-heterogeneous distribution of values can be confirmed through observation of value distribution on a scatter-plot or through uni-variate analysis. Violations of these statistical assumptions would serve to limit further parametric or predictive analysis and interpretations possible through graphical representation.

Single group statistics were to be calculated and variances compared. However, as the limitations of the data in meeting parametric and linear assumptions did not permit equivalent comparisons, a non-parametric procedure, the Kruskal-Wallace H test was used as a test of ranking or comparing more than two independent samples. This was necessary to determine where each group of respondents would rank with respect to the total number of surveys returned. The total number of surveys was selected as the measure that would provide the greatest differentiation of each group response when compared. Additionally, descriptive statistics for each dimension of change along with an aggregate of scores of dimensions to describe overall group level of satisfaction was calculated. Dimensions of change or satisfaction are also described statistically for the aggregate of scores for all groups included in the sample. Auto correlation procedures were calculated in SINGWIN for each group as the program is designed to be sensitive to autocorrelation in time series designs when there are a small number of observations over time.

Multiple group statistics were calculated. Scores were taken from the first time of measurement were compared across groups so that independence was assured and autocorrelation is not a complicating issue in reliability or baseline comparison analysis.

Additionally, scores may be taken at intervals of weeks or sessions across all groups in the sample to serve as a basis of comparison of change over time or across groups. Where possible intervals selected are the same for all groups compared with respect to intervention level change or specific dimension of change.

A reliability analysis was conducted to evaluate the reliability of the scale. The analysis used scores from the first time measured in the time series to assure independence of responses. A covariance matrix was used to determine reliability. An alpha (Cronbach) statistic was preferred as a model of internal consistency, based on the average inter-item correlation. An alpha reliability coefficient was determined with a standardized item alpha determined for the eight items contained within the scale. The overall scale mean and standard deviation were calculated. The mean value for specific items was derived with the mean of item variances also determined. This reliability analysis procedure calculates a number of commonly used measures of scale reliability and was selected to provide information about the relationships between individual items in the scale and the overall reliability of the scale.

A principal axis factor analysis was performed, as the least number of factors that can account for the common variance (correlation) of a set of variables was sought, to determine the number of factors included in the survey instrument. The components (factors) were extracted with an estimate of explained variance derived. Communalities values suggested that items were interrelated in the matrix and represented a one-dimensional scale. Further analysis of pair wise correlations was completed to determine whether the item inter-correlations between variables were less than would be required to consider the elimination of an item from the survey instrument.

Tests for autocorrelation of time series values in individual groups using the RF2/TF2 method were completed in SINGWIN to evaluate group satisfaction and individual dimensions of change. This method evaluated change in the range of data values during the intervention portion of the group process to determine if serial dependence existed. Test results for all groups were entered into a table, summarized, and presented with a moving average graphical representation for each group using the graphical tool available in this application.

Tests for autoregression of time series values across all groups for each dimension of change were evaluated for significance using the SPSS application. The starting value for Rho, the autoregressive parameter was 0, which was entered as a value into the initial value settings of autoregressive parameter (Rho) for the SPSS autoregression analysis. Results were entered into a table, summarized and presented with dimensions of change found to be significant variables even though significance is identified for the autoregressive model.

Establishing Guidelines for Usage

Graphical representations produced in this study were then categorized based on a number of practical considerations. Initial criteria were established based on the availability of the application to practitioners, ease of construction of the graphical representation, and a description of the type(s) of information conveyed by the graphic. Additionally, established conventions related to formatting and using the graphic as available in the relevant literature is presented to provide guidelines for utilization. As this study is exploratory and descriptive in nature, confirmation of utility in practice settings will be deferred for future research. The criteria presented in this study were formatted into a reference table to provide guidelines that will enable the practitioner to select a data visualization approach for an applied group service evaluative need.

Chapter IV:

RESULTS SECTION

Organization and Presentation of Results

Data are available from 247 subjects who participated in 16 experiential group therapy intervention education groups and completed surveys for 2396 data points, or times of observation. However, in selected instances not all participants completed surveys for each time of observation. For example, 231 participants in all of the 16 groups completed the first administration of the survey in their respective group.

The results of the study are organized, so that each of the groups is evaluated both graphically and statistically before presentation of findings for all groups combined. A brief description of the construction and type of graphical representations included for analysis is presented in the results section for Group 1. These descriptions are provided to aid in the visual understanding of the graphical representations included in the study results. Summaries of results for Group 2 through 16 contain brief and succinct descriptions. Several of the produced graphical representations have accompanying statistical tables of values that facilitate ease of interpretation of the values depicted for the graphic displayed. All tables and all figures have been placed in the appendices to make the results section more readable due to the large number of tables and graphics presented. However, each table and figure will be referred to in the text. Following presentation of findings for each of the 16 individual groups, a section of findings for multiple groups, or all groups combined will be presented including a description of the construction and interpretation of graphical results. Issues of instrument reliability are then presented in the last section following the section on evaluation of all groups combined.

Group 1 Results Summary

The first Group Therapy Education Group, hereafter referred to as Group 1, had 22 subjects and convened for 13 sessions. During these periods of observation, 247 group surveys were returned that yielded an average group satisfaction mean of 7.90, Standard deviation (St.Dev.) = 1.07, Standard error of the mean (SEM) = .07, Variance = 1.14, Skewness = -2.16, and Kurtosis = 8.45.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in Figure 1 which demonstrates an initial increase in aggregate group satisfaction during the second observation with a drop off of satisfaction in the third observation and a gradual increase over remaining weeks. The line graph was produced in a Microsoft Excel application. The values corresponding with the graphed data points of line graph are presented in Table 1 which set the average group satisfaction level for the second observation (Mean = 8.17) and a decline (Mean = 7.08) by the third observation and a gradual increase (Mean = 8.70) by the final group session.

Standard Deviation Enhanced Line Graph One standard deviation above and below the mean for each time of observation was calculated. Additional lines were entered into the graphic to provide additional evaluative information on the level of agreement of group participants with respect to perceived satisfaction within the group. These values are illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 2 that demonstrates greatest variation the third, fourth, and fifth time of observation. Greatest group concordance was observed at the last, or thirteenth time, of observation and an earlier period of observed group concordance is noted at the sixth time of observation. The graphical representation provides evaluative information on the degree of agreement or overall cohesion within the group. The standard deviation enhanced line graph (SDELG) was produced through the use of the Microsoft Excel spreadsheet application. The values corresponding with the graphed standard deviation data points per time of observation are also given in Table 1.

<u>Area Graph</u> An area graph was then produced for each individual group in the Excel program. The area graph depicts the proportional contribution of each of the survey items or dimensions of group satisfaction. These include time (the perception of time available to complete group tasks), leadership (the perception or confidence in the group leader to facilitate the group process), comfort (the perception of environmental comfort such as seating, room temperature, ambient light, and noise, etc. as related to contributing to the positive or negative group experience), trust (the level of perceived trust among group members and the group leader and members), respect (the level of perceived trust among group members and between the group leader and members) , honesty (the level of perceived honesty among group members and the between the group leader and members), sharing (the level of perceived openness and sharing among group members and between the group leader and members), and cohesion (the overall “esprit de corps,” sense of we-ness, or belonging to and being a valued member of the group). The area graph further sorts these dimensions as measured over time based on the variability of each dimension for each individual group, by sorting each dimension by the standard deviation of the proportional values of the dimension so that those dimensions with least variance are placed nearest to the X axis and those with greater variability are sorted

above. Those dimensions acting as the unvarying substrate for the group change effort are nearest the X axis with those dimensions having greater variability in their proportional contribution to overall change represented in each higher dimension on the area graph as demonstrated in Figure 3 which illustrates time, cohesion, sharing, and leadership as the stable dimensions contributing to group satisfaction and comfort, trust, respect, and honesty being more variable. Although more variable, the dimension of honesty proportionally contributes less than most other dimensions during early formative weeks of group development. The values that correspond with each dimension of change average, as plotted over time, are given in Table 2. These values are used to calculate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 3.

<u>Three-Dimensional Surface Plot of Individual Subjects</u> A three-dimensional surface plot representing each of the subjects participating in each group was constructed to provide a visual basis for comparing the individual's average rating of satisfaction across weeks. Subject number identifies the individual and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. The individuals participating in the group are then sorted based on the sum of their average scores over the weeks of observation in the group. Those subjects with the highest sum of average group satisfaction scores are sorted so that their scores appear visually at the distal portion or back of the surface plot. As subject's sums of average group satisfaction scores decrease, they appear more proximally or closer to the front of the surface plot. This arrangement provides evaluative information on the critical junctures in the group time sequence where the group did not perform as well or were less satisfied, identifies

those subjects who performed well or were more satisfied with the group, and visually represents those subjects with the greatest degree of change over the duration of the group. The three dimensional surface plot of individual subject satisfaction across weeks was constructed in the Microsoft Excel application as seen in Figure 4. From this figure Subject 14 and Subject 18 are represented to have reported lower average satisfaction values and did not reach optimum levels, whereas Subject 1 and Subject 20 reported optimum levels of satisfaction throughout the 13 times of observation, or group sessions. Optimum levels are score averages of between 8 and 9 on the 9-point survey scale. The values that correspond with each subject's data points plotted over time are given in Table 4.

<u>Three-Dimensional Surface Plot of Dimensions of Change</u> A three-dimensional surface plot of the survey items or dimensions of change relative to satisfaction averaged across weeks was constructed. This representation provides evaluative information at critical junctures in the group process. This representation also demonstrate the points of observation where the combined perception of group participants relative to each surveyed item or dimension of change is not stable, or in transition, indicating some level of group turbulence or dimensional change occurring. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. Each dimension is sorted on the sum of the average score of the dimension so that those dimensions rated with higher average values are located more distally or toward the back of the chart field and those dimensions with lesser average values appear more proximally or toward the front of the visual field of the chart. The three-dimensional surface plot of dimensions of change across weeks was

constructed in the Microsoft Excel program as seen in Figure 5. The average of the dimension of comfort is the lowest average value across weeks and the dimension of respect is the highest average value across weeks. A trough effect is seen for the decrease in average values across all dimensions occurring in weeks three, and four with the dimension of cohesion being the most affected, and with a second trough occurring in week 6. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 2.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed in the SPSS program, to evaluate the normality of distribution of the average satisfaction scores. Each histogram represents the frequency of each occurring average satisfaction score value within 1.0 a unit as represented by the survey instrument. The mean score of average satisfaction and standard deviation is given for each group. The "N" value refers to the number of group surveys included in the group over time rather than the number of participants, as seen in Figure 6 (Mean = 7.9, St. Dev. = 1.07 and surveys completed N = 247). The histogram indicates non-normally skewed and kurtotic distribution of values. All histograms for each group and all groups combined have been placed on the same scale to facilitate consistency in visual comparison.

Scatterplot to Evaluate Linearity The SPSS program also was used to construct a scatter-plot to evaluate predicted and observed group satisfaction values for each group and to determine whether a linear model would be a good choice with respect to predicting group satisfaction over time. Research scholars attempting to evaluate linearity in a multivariate problem would commonly use this method. However, an alternate method would have been to present a scatter-plot with time and the dependent variable which would have provided the same information and could have been, arguably, more easily interpreted. In the scatter-plot method selected though, average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. A linear relationship between the variables could be evaluated by observing whether these values clustered so as to form a line of equal, or nearly equal variances. As demonstrated in Figure 7 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

<u>Scatterplot to Evaluate Independence</u> The SPSS program was then used to construct a scatterplot to evaluate the assumption of independence of observations. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Scatterplots produced could then be examined to identify whether a relationship between the studentized residuals and the order in which data were obtained was present. An observed association in the direction of change over the order of observations would suggest a decrease of independence of observations over the order of observations. Additionally, the Durbin-Watson test was used to see if adjacent observations were correlated with model values for the dependent variable of average satisfaction calculated (R = .37, R^2 = .14, Adj. R^2 = .14, Std. Error of the Estimate = .99, Durbin-Watson = 1.8) as seen in the scatterplot in Figure 8. There is little evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test suggests a very minimally negative relationship between adjacent values.

Moving Average Line Graph A moving average line graphical representation of the difference between group time series values without and then with a correction for autocorrelated values was constructed in the SINGWIN application. The graphical representation was constructed by entering the average of group satisfaction for all subjects in each group, per period of measurement with this value treated as a score value for the software which evaluate single subject design interventions. The first observed average group satisfaction value was entered as the baseline value with other observations entered into the intervention phase. As mentioned earlier, baseline first observation data was selected to demonstrate initial values prior to the possibility of auto-correlation due to evaluating observations over time. The baseline data provided a visual method of evaluating change during the intervention phase, however as autocorrelation was possible, a moving average line was constructed to compensate for change in scores in the intervention phase that could be due to autocorrelated error. The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 9. What is most notable about this graphic is the Intervention Behavior line and the Intervention Moving Average differences at t2 (time of observation) and t 6 (time of observation) that may be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 22, $^{r}{}_{F2}$ = 1.0227, Mean = 7.95 $^{t}{}_{F2}$ value = 3.44, DF = 17, p = .003) the autocorrelation values are determined to be significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, constructed in the Excel application and may be referred to in Table 1. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart Next, the X-bar R-chart was constructed in the Excel add-on application for Statistical Process Control charts. The X-bar R-chart for Group 1 depicts the process mean, at times of observation, compared to the projected average of all scores (Mean of average scores = 7.94), and is further bound by a fixed upper two standard deviation control limit (UCL = 9.17) and a lower two standard deviation control limit (LCL = 6.72) for each group as seen in Figure 10. To maintain a basis of comparison from group to group the average value of each dimension of change was entered for each period of observation. By this method a dimensional score was determined for each observation period, and this method permitted the same number of score values to be entered into the spreadsheet for each group. However, the number of weeks or times of observation differ for each group. Values corresponding to the average score per time of observation and score range are available in Table 5. Average scores of group satisfaction per time of observation were selected to provide a basis for comparison of group level change. Alternatives of individual scores, and scores for a particular variable would not have provided a basis for the visual comparison of group level change. Trends in average group level satisfaction are observed to be less than two standard deviations from the group mean.

R- Chart Finally, an R-chart was constructed in the Excel add-on application for Statistical Process Control charts. The R-chart depicts the range of scores at times of observation, and compares to the projected average of all scores (Mean of average scores = 1.77), and is further bound by a fixed upper control limit (UCL = 4.04) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations for each group. To maintain a basis of comparison from group to group the average value of each dimension of change was entered for each period of observation. By this method, a dimensional score was determined for each observation period, and permitted the same number of score values to be entered into the spreadsheet for each group. However, the number of weeks or times of observation differ for each group. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero throughout all 16 groups and is graphically represented for this group in Figure 11. Values corresponding to the average score per time of observation and score range are available in Table 5.

Group 2 Results Summary

The second Group Therapy Education Group, hereafter referred to as Group 2, had 14 subjects and convened for 12 sessions. During these periods of observation, 156 group surveys were returned that yielded an average group satisfaction mean of 7.79, Standard deviation (St.Dev.) = 1.05, Standard error of the mean (SEM) = .08, Variance = 1.11, Skewness = -.89, and Kurtosis = .10.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 12 which demonstrates increases in aggregate group satisfaction during the first through the fourth observation with a gradual decrease of satisfaction through the eighth observation and a gradual increase over remaining weeks. The values corresponding with the graphed data points of line graph representation are given in Table 6 which set the average group satisfaction level for the fourth observation (Mean = 8.04) and a decline (Mean = 7.74) by the fifth observation and a gradual increase (Mean = 8.45) by the final group session.

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 13. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 6. Greatest agreement occurs in the sixth and twelfth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated as seen in Figure 14. Those dimensions having least variability are plotted nearest the X- axis and dimensions with greater variability are plotted higher on the Y- axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 7. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 8. Comfort, cohesion, and trust show limited variability, while dimensions of sharing, time, leadership, honesty, and respect show an increasing variability with near equivalent proportional contributions of all dimensions.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 15. From this figure Subjects 10, 12, 2, and 6 are represented to have reported lower average satisfaction values and did not reach the optimum levels of average scores between 8 and 9, whereas Subjects 9, 11, and 1 reported optimum levels of satisfaction throughout the 12 times of observation, or group sessions. The values that correspond with each subject's data points plotted over time are given in Table 9.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks was constructed in the Microsoft Excel program as seen in Figure 16. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. Each dimension is sorted on the sum of the average score of the dimension so that those dimensions rated with higher average values are located more distally or toward the back of the chart field and those dimensions with lesser average values appear more proximally or toward the front of the visual field of the chart. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 7. The dimension of comfort averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks. All of the dimensions surveyed were at optimum levels by the last period of observation.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The "N" value for this group refers to the number of group surveys included in the group over time rather than the number of participants, as seen in Figure 17 (Mean = 7.80, St. Dev. = 1.05 and surveys completed N = 156). The histogram indicates non-normally skewed and kurtotic distribution of values.

Scatterplot to Evaluate Linearity A scatterplot was constructed in SPSS to evaluate predicted and observed group satisfaction values for each group and to determine whether a linear model would be a good choice with respect to predicting group satisfaction over time. Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 18 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence A scatterplot to evaluate the assumption of independence of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .312, R^2 = .10, Adj. R^2 = .09, Std. Error of the Estimate = 1.00, Durbin-Watson = 2.46) as seen in the scatterplot in Figure 19. There is little evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test suggests a very minimal relationship between adjacent values.

Moving Average Line Graph A moving average line graphical representation of the difference between group time series values without and then with a correction for autocorrelated values was constructed. The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 20. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t2 (time of observation) and t 6 (time of observation) may be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN ${}^{r}{}_{F2}$ method (n= 14, ${}^{r}{}_{F2}$ = 0.9153, Mean = 7.86 ${}^{t}{}_{F2}$ value = 2.23, DF = 16, p = .040) the autocorrelation values are determined to be significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 6. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 2 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 7.80), and is further bound by a fixed upper two standard deviation control limit (UCL = 8.72) and lower two standard deviation control limit (LCL = 6.87) for each group as seen in Figure 21. Values corresponding to the average score per time of observation and score range are available in Table 10.

R- Chart An R-chart was constructed in the Excel add-on application for Statistical Process Control charts. As before, the R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.65), and is further bound by a fixed upper control limit (UCL = 3.75) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero and is graphically represented for this group in Figure 22. Values corresponding to the average score per time of observation and score range are available in Table 10.

Group 3 Results Summary

The third Group Therapy Education Group, hereafter referred to as Group 3, had 10 subjects and convened for 11 sessions. During these periods of observation, 104 group surveys were returned that yielded an average group satisfaction mean of 8.29, Standard deviation (St.Dev.) = .96, Standard error of the mean (SEM) = .09, Variance = .92, Skewness = - 4.37, and Kurtosis = 28.26.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 23, which demonstrates increases in aggregate group satisfaction during the first through third observation with a gradual decrease of satisfaction through the seventh observation and a gradual increase over remaining weeks. The values corresponding with the graphed data points of line graph representation are given in Table 11 which set the average group satisfaction level for the third observation (Mean = 8.63) and a decline (Mean = 7.90) by the seventh observation and a gradual increase (Mean = 8.81) by the final group session.

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 24. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 11. Greatest agreement occurs in the sixth and eleventh period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 25. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 12. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 13. Leadership, respect, and time show limited variability, while dimensions of honesty, cohesion, sharing, trust, and comfort show an increasing variability with decreasing proportional contributions of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 26. From this figure Subjects 5, 9, 10, and 7 are represented to have reported lower average satisfaction values and did however reach optimum levels of an average score values of between 8 and 9, whereas Subjects 8, 6, and 4 reporting optimum levels of satisfaction throughout the 11 times of observation, or group sessions. The values that correspond with each subject's data points plotted over time are given in Table 14.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks is illustrated in Figure 27. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 12. The dimension of comfort averaged the lowest values across weeks and the dimension of leadership averaged the highest values across weeks. All of the dimensions surveyed were at optimum levels by the last period of observation.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The "N" value for this group refers to the number of group surveys included in the group over time rather than the number of participants, is seen in Figure 28 (Mean = 8.30, St. Dev. = .96 and surveys completed N = 104). The histogram indicates extremely non-normally skewed and a kurtotic distribution of values.

Scatterplot to Evaluate Linearity A scatterplot was constructed in SPSS to evaluate predicted and observed group satisfaction values for each group and to determine whether a linear model would be a good choice with respect to predicting group satisfaction over time. Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 29 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence A scatterplot to evaluate the assumption of independence of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .199, R^2 = .0039, Adj. R^2 = .030, Std. Error of the Estimate = .947, Durbin-Watson = 1.96) as seen in the scatterplot in Figure 30. There is little evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does NOT suggest a relationship between adjacent values.

Moving Average Line Graph The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 31. What is most notable about this graphic is the Intervention Behavior line and the Intervention Moving Average differences at t7 (time of observation) and t 8 (time of observation) that may NOT be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN ${}^{r}{}_{F2}$ method (n= 10, ${}^{r}{}_{F2}$ = 0.3331, Mean = 8.36 ${}^{t}{}_{F2}$ value = 1.77, DF = 15, p = .097) the autocorrelation values are determined to be NOT significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 11. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 3 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 8.31), and is further bound by a fixed upper two standard deviation control limit (UCL = 9.19) and lower two standard deviation control limit (LCL = 7.43) for each group as seen in Figure 32. Values corresponding to the average score per time of observation and score range are available in Table 15.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.98), and is further bound by a fixed upper control limit (UCL = 2.91) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero throughout all 16 groups and is graphically represented for this group in Figure 33. Values corresponding to the average score per time of observation and score range are available in Table 15.

Group 4 Results Summary

The fourth Group Therapy Education Group, hereafter referred to as Group 4, had 14 subjects and convened for 9 sessions. During these periods of observation, 122 group surveys were returned that yielded an average group satisfaction mean of 7.36, Standard deviation (St.Dev.) = 1.09, Standard error of the mean (SEM) = .09, Variance = 1.18, Skewness = - .37, and Kurtosis = -.83.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 34 which demonstrates increases in aggregate group satisfaction during the second observation with a decrease of satisfaction in the third observation and a gradual increase in the fourth with a leveling off over remaining weeks. The values corresponding with the graphed data points of line graph representation are given in Table 16 which set the average group satisfaction level for the second observation (Mean = 7.62) and a decline (Mean = 6.87) by the third observation and a gradual increase (Mean = 7.50) by the final group session.

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 35. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 16. Greatest agreement occurs in the seventh and ninth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 36. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 17. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 18. Comfort, trust, and sharing show limited variability, while dimensions of cohesion, respect, time, leadership, and honesty show an increasing variability with relatively equivalent proportional contributions of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Figure 37. From this figure Subjects 11, 12 6, 14, 5, 1, and 3 are represented to have reported lower average satisfaction values and did however reach optimum levels of average score values of between 8 and 9, whereas Subjects 9 and 8 reported optimum levels of satisfaction throughout the 9 times of observation, or group sessions. The values that correspond with each subject's data points plotted over time are given in Table 19.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks was constructed in the Microsoft Excel program as seen in Figure 38. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. Each dimension is sorted on the sum of the average score of the dimension so that those dimensions rated with higher average values are located more distally or toward the back of the chart field and those dimensions with lesser average values appear more proximally or toward the front of the visual field of the chart. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 17. The dimension of comfort averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks. All of the dimensions surveyed decreased with exception of honesty by the last period of observation.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The "N" value for this group refers to the number of group surveys included in the group over time rather than the number of participants, is seen in Figure 39 (Mean = 7.35, St. Dev. = 1.09 and surveys completed N = 122). The histogram indicates skewed and a kurtotic distribution of values.

Scatterplot to Evaluate Linearity A scatterplot was constructed in SPSS to evaluate predicted and observed group satisfaction values for each group and to determine whether a linear model would be a good choice with respect to predicting group satisfaction over time. Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 40 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence A scatterplot to evaluate the assumption of independence of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are ($R = .120$, $R^2 = .014$, Adj. $R^2 = .003$, Std. Error of the Estimate = 1.08, Durbin-Watson = 1.64) as seen in the scatterplot in Figure 41. There is little evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does NOT suggest a relationship between adjacent values.

Moving Average Line Graph A moving average line graphical representation of the difference between group time series values without and then with a correction for autocorrelated values was constructed. The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 42. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t3 (time of observation) and t 4 (time of observation) may NOT be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN ${}^{r}{}_{F2}$ method (n= 14, ${}^{r}{}_{F2}$ = 0.0925, Mean = 7.38 ${}^{t}{}_{F2}$ value = 1.66, DF = 13, p = .119) the autocorrelation values are determined to be NOT significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 16. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 4 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 7.34), and is further bound by a fixed upper two standard deviation control limit (UCL = 8.72) and lower two standard deviation control limit (LCL = 5.97) for each group as seen in Figure 43. Values corresponding to the average score per time of observation and score range are available in Table 20.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.77). The R-chart is further bound by a fixed upper control limit (UCL = 4.04) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. The average value of each dimension of change was entered for each period of observation. By this method, a dimensional score was determined for each observation period. By using average dimensional values the same number of score values could be entered into the spreadsheet for each group. However, the number of weeks or times of observation differ for each group. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores, is zero and is graphically represented for this group in Figure 44. Values corresponding to the average score per time of observation and score range are available in Table 20.

Group 5 Results Summary

The fifth Group Therapy Education Group, hereafter referred to as Group 5, had 16 subjects and convened for 10 sessions. During these periods of observation, 158 group surveys were returned that yielded an average group satisfaction mean of 7.98, Standard deviation (St.Dev.) = 1.13, Standard error of the mean (SEM) = .09, Variance = 1.29, Skewness = - 3.09, and Kurtosis = 14.96.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 45 which demonstrates increases in aggregate group satisfaction during the second observation with a decrease of satisfaction in the third and fourth observations and a gradual increase through the ninth observation and a final decrease in the last week. The values corresponding with the graphed data points of line graph representation are given in Table 21 which set the average group satisfaction level for the second observation (Mean = 8.14) and a decline (Mean = 7.72) by the fourth observation and a gradual increase (Mean = 8.73) by the ninth observation and decrease (Mean = 8.50) by the final group session.

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 46. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 21. Greatest agreement occurs in the fifth and ninth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 47. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 22. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 23. Comfort, sharing, and time show limited variability, while dimensions of cohesion, honesty, leadership, and respect show an increasing variability with decreasing proportional contributions of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 48. From this figure Subjects 7, 13 and 11 are represented to have reported lower average satisfaction values and did not reach optimum levels of average score values of between 8 and 9, whereas Subjects 16, 1 and 3 reported optimum levels of satisfaction throughout the 10 times of observation, or group sessions. The values that correspond with each subject's data points plotted over time are given in Table 24.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks was constructed in the Microsoft Excel program as seen in Figure 49. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 22. The dimension of comfort averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks. All of the dimensions surveyed increased by the last period of observation.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The "N" value for this group refers to the number of group surveys included in the group over time rather than the number of participants, as seen in Figure 50 (Mean = 8.04, St. Dev. = 1.14 and surveys completed N = 158). The histogram indicates skewed and a kurtotic distribution of values.

Scatterplot to Evaluate Linearity A scatterplot was constructed in SPSS to evaluate predicted and observed group satisfaction values for each group and to determine whether a linear model would be a good choice with respect to predicting group satisfaction over time. Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 51 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence A scatterplot to evaluate the assumption of independence of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are ($R = .207$, $R^2 = .043$, Adj. $R^2 = .037$, Std. Error of the Estimate = 1.11, Durbin-Watson = 1.795) as seen in the scatterplot in Figure 52. There is little evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does suggest a minimally positive relationship between adjacent values.

Moving Average Line Graph A moving average line graphical representation of the difference between group time series values without and then with a correction for autocorrelated values was constructed. The intervention behavior and the moving average the group satisfaction values are represented as lines and are clearly labeled in Figure 53. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t3 (time of observation) and t 8 (time of observation) may NOT be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 16, $^{r}{}_{F2}$ = 01.0775, Mean = 8.04 $^{t}{}_{F2}$ value = 1.62, DF = 14, p = .126) the autocorrelation values are determined to be NOT significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 21. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 5 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 7.99), and is further bound by a fixed upper two standard deviation control limit (UCL = 8.97) and lower two standard deviation control limit (LCL = 7.00) for each group as seen in Figure 54. Values corresponding to the average score per time of observation and score range are available in Table 25.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.42) The R-chart is further bound by a fixed upper control limit (UCL = 3.25) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. To maintain a basis of comparison from group to group the average value of each dimension of change was entered for each period of observation. By entering the average dimensional score value for each dimension the overall dimensional score was determined for each observation period. This permitted the same number of score values to be entered into the spreadsheet for each group. However, the number of weeks or times of observation differ for each group. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero and is graphically represented for this group in Figure 55. Values corresponding to the average score per time of observation and score range are available in Table 25.

Group 6 Results Summary

The sixth Group Therapy Education Group, hereafter referred to as Group 6, had 11 subjects and convened for 9 sessions. During these periods of observation, 92 group surveys were returned that yielded an average group satisfaction mean of 7.79, Standard deviation (St.Dev.) = .81, Standard error of the mean (SEM) = .08, Variance = .66, Skewness = - .74, and Kurtosis = .33.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 56 which demonstrates increases in aggregate group satisfaction during the third and fourth observations with a decrease of satisfaction in the fifth observation and an increase during the seventh observation with a decrease through the ninth and final decrease observation. The values corresponding with the graphed data points of line graph representation are given in Table 26 which set the average group satisfaction level for the fourth observation (Mean = 8.13) and a decline (Mean = 6.98) by the sixth observation and an increase (Mean = 8.35) and decrease by the ninth and final group session (Mean = 7.97).

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 57. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 26. Greatest agreement occurs in the sixth and ninth period of observation.

<u>Area Graph</u> An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 58. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 27. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 28. Comfort, trust, leadership, and, cohesion show limited variability, while dimensions of sharing, honesty, time, and respect show an increasing variability with decreasing proportional contributions of dimensions as variation increases.

<u>Three-Dimensional Surface Plot of Individual Subjects</u> The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 59. From this figure Subjects 3, 4, 9 and 11 are represented to have reported lower average satisfaction values and did reach optimum levels during the middle and end of times of observation whereas Subjects 2, 10, 1, 5, and 8 reported optimum levels of satisfaction throughout most of the times of observation, or group sessions other than

session 6. The values that correspond with each subject's data points plotted over time are given in Table 29.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks was constructed in the Microsoft Excel program as seen in Figure 60. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. Each dimension is sorted on the sum of the average score of the dimension so that those dimensions rated with higher average values are located more distally or toward the back of the chart field and those dimensions with lesser average values appear more proximally or toward the front of the visual field of the chart. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 27. The dimension of comfort averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks. All of the dimensions surveyed increased by the last period of observation. However, in session six all dimensions were negatively affected during the same period of observation and did not reach optimal levels.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The "N" value for this group refers to the number of group surveys included in the group over time rather than the number of participants, as seen in Figure 61 (Mean = 7.79, St. Dev. = .82 and surveys completed N = 92). The histogram indicates skewed and a kurtotic distribution of values.

Scatterplot to Evaluate Linearity A scatterplot was constructed in SPSS to evaluate predicted and observed group satisfaction values for each group and to determine whether a linear model would be a good choice with respect to predicting group satisfaction over time. Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 62 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence A scatterplot to evaluate the assumption of independence of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .214, R^2 = .046, Adj. R^2 = .035, Std. Error of the Estimate = .80, Durbin-Watson = 1.707) as seen in the scatterplot in Figure 63. There is little evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does suggest a minimally positive relationship between adjacent values.

Moving Average Line Graph A moving average line graphical representation of the difference between group time series values without and then with a correction for autocorrelated values was constructed. The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 64. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t3, t5 (times of observation) and t6 (time of observation) may NOT be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n = 11, $^{r}{}_{F2}$ = -0.0675, Mean = 7.81 $^{t}{}_{F2}$ value = 1.82, DF = 13, p = .091) the autocorrelation values are determined to be NOT significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 26. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 6 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 7.79), and is further bound by a fixed upper standard deviation control limit (UCL = 9.03) and lower two standard deviation control limit (LCL = 6.56) for each group as seen in Figure 65. Values corresponding to the average score per time of observation and score range are available in Table 30.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.91). The R-chart is further bound by a fixed upper control limit (UCL = 4.37) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. To maintain a basis of comparison the average value of each dimension of change was entered for each period of observation. By this method, a dimensional score was determined for each observation period. This permitted the same number of score values to be entered into the spreadsheet for each group. However, the number of weeks or times of observation differ for each group. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero and is graphically represented for this group in Figure 66. Values corresponding to the average score per time of observation and score range are available in Table 30.

Group 7 Results Summary

The seventh Group Therapy Education Group, hereafter referred to as Group 7, had 18 subjects and convened for 8 sessions. During these periods of observation, 139 group surveys were returned that yielded an average group satisfaction mean of 7.63, Standard deviation (St.Dev.) = .86, Standard error of the mean (SEM) = .07, Variance = .74, Skewness = - .79, and Kurtosis = .42.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 67, which demonstrates gradual increases in aggregate group satisfaction during the second and fourth observations and an increase during the sixth through eighth and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 31 which set the average group satisfaction level for the second observation (Mean = 7.60) and an increase in the fourth observation (Mean = 7.66) by the sixth observation another increase starting at (Mean = 7.40) and increasing by the final group session to (Mean = 8.08).

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 68. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 31. Greatest agreement occurs in the second, sixth and seventh period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 69. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 32. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 33. Leadership, respect, honesty, and time show limited variability, while dimensions of trust, sharing, cohesion, and comfort show an increasing variability with nearly equivalent proportional contributions of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 70. From this figure Subjects 3, 12, 18, 4 and 7 are represented to have reported lower average satisfaction values and did reach optimum levels during the middle and end of times of observation whereas Subjects 13, 10, 16, 5 and 17 reported optimum levels of satisfaction throughout most of the times of observation, or group sessions other than session 5. The values that correspond with each subject's data points plotted over time are given in Table 34.

<u>Three-Dimensional Surface Plot of Dimensions of Change</u> The three-dimensional surface plot of dimensions of change across weeks was constructed in the Microsoft Excel program as seen in Figure 71. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. Each dimension is sorted on the sum of the average score of the dimension so that those dimensions rated with higher average values are located more distally or toward the back of the chart field and those dimensions with lesser average values appear more proximally or toward the front of the visual field of the chart. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 32. The dimension of comfort averaged the lowest values across weeks and the dimension of leadership averaged the highest values across weeks. All of the dimensions surveyed increased by the last period of observation.

<u>Histogram</u> A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The "N" value for this group refers to the number of group surveys included in the group over time rather than the number of participants, as seen in Figure 72 (Mean = 7.63, St. Dev. = .86 and surveys completed N = 139). The histogram indicates skewed and a kurtotic distribution of values.

<u>Scatterplot to Evaluate Linearity</u> A scatterplot was constructed in SPSS to evaluate predicted and observed group satisfaction values for each group and to determine whether

a linear model would be a good choice with respect to predicting group satisfaction over time. Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 73 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence A scatterplot to evaluate the assumption of independence of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .306, R^2 = .093, Adj. R^2 = .087, Std. Error of the Estimate = .82, Durbin-Watson = 2.164) as seen in the scatterplot in Figure 74. There is little evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does NOT suggest a relationship between adjacent values.

Moving Average Line Graph A moving average line graphical representation of the difference between group time series values without and then with a correction for autocorrelated values was constructed. The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 75. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t4 (times of observation) and t5 (time of observation) may be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 18, $^{r}{}_{F2}$ = -1.0058, Mean = 7.71 $^{t}{}_{F2}$ value = 6.44, DF = 12, p = .000) the autocorrelation values are determined to be significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 31. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 7 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 7.62), and is further bound by a fixed upper two standard deviation control limit (UCL = 8.80) and a lower two standard deviation control limit (LCL = 6.45) for each group as seen in Figure 76. Values corresponding to the average score per time of observation and score range are available in Table 35.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.65). The R-chart is further bound by a fixed upper control limit (UCL = 3.77) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. To maintain a basis of comparison the average value of each dimension of change was entered for each period of observation. By this method, a dimensional score was determined for each observation period. This permitted the same number of score values to be entered into the spreadsheet for each group. However, the number of weeks or times of observation differ for each group. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero and is graphically represented for this group in Figure 77. Values corresponding to the average score per time of observation and score range are available in Table 35.

Group 8 Results Summary

The eighth Group Therapy Education Group, hereafter referred to as Group 8, had 9 subjects and convened for 12 sessions. During these periods of observation, 105 group surveys were returned that yielded an average group satisfaction mean of 7.88, Standard deviation (St.Dev.) = 1.15, Standard error of the mean (SEM) = .11, Variance = 1.33, Skewness = - 1.05, and Kurtosis = .26.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 78, which demonstrates increase in aggregate group satisfaction during the third and sixth observations and an increase during the tenth through twelfth and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 36 which set the average group satisfaction level for the third observation (Mean = 8.72) and an increase in the sixth observation (Mean = 8.33) by the tenth observation another increase starting at (Mean = 8.06) and increasing by the final group session to (Mean = 8.89).

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 79. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 36. Greatest agreement occurs in the third, sixth and twelfth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 80. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 37. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 38. Time, leadership, respect, and, honesty show limited variability, while dimensions of trust, sharing, cohesion, and comfort show an increasing variability with nearly less proportional contribution of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 81. From this figure Subjects 9 and 5 are represented to have reported lower average satisfaction values and did reach optimum levels during times of observation whereas Subjects 2, 6 and 4 reported optimum levels of satisfaction throughout most of the times of observation, or group sessions other than session 9. The values that correspond with each subject's data points plotted over time are given in Table 39.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks was constructed in the Microsoft Excel program as seen in Figure 82. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. Each dimension is sorted on the sum of the average score of the dimension so that those dimensions rated with higher average values are located more distally or toward the back of the chart field and those dimensions with lesser average values appear more proximally or toward the front of the visual field of the chart. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 37. The dimension of comfort averaged the lowest values across weeks and the dimension of time averaged the highest values across weeks. All of the dimensions surveyed increased by the last period of observation.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The "N" value for this group refers to the number of group surveys included in the group over time rather than the number of participants, as seen in Figure 83 (Mean = 7.88, St. Dev. = 1.15 and surveys completed N = 105). The histogram indicates skewed and a kurtotic distribution of values.

Scatterplot to Evaluate Linearity A scatterplot was constructed in SPSS to evaluate predicted and observed group satisfaction values for each group and to determine whether a linear model would be a good choice with respect to predicting group satisfaction over time. Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 84 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence A scatterplot to evaluate the assumption of independence of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .223, R^2 = .050, Adj. R^2 = .040, Std. Error of the Estimate = 1.13, Durbin-Watson = 1.313) as seen in the scatterplot in Figure 85. There is little evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does suggest a minimally negative relationship between adjacent values.

Moving Average Line Graph A moving average line graphical representation of the difference between group time series values without and then with a correction for autocorrelated values was constructed. The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 86. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t4, t5, t8 (times of observation) and t9 (time of observation) may be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 9, $^{r}{}_{F2}$ = 0.0467, Mean = 7.90 $^{t}{}_{F2}$ value = 2.23, DF = 16, p = .040) the autocorrelation values are determined to be significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 36. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 8 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores =7.89), and is further bound by a fixed upper two standard deviation control limit (UCL = 9.02) and lower two standard deviation control limit (LCL = 6.76) for each group as seen in Figure 87. Values corresponding to the average score per time of observation and score range are available in Table 40.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.65). The R-chart is further bound by a fixed upper control limit (UCL = 3.77) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. To maintain a basis of comparison from group to group the average value of each dimension of change was entered for each period of observation. By this method, a dimensional score was determined for each observation period. This permitted the same number of score values to be entered into the spreadsheet for each group. However, the number of weeks or times of observation differ for each group. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero and is graphically represented for this group in Figure 88. Values corresponding to the average score per time of observation and score range are available in Table 40.

Group 9 Results Summary

The ninth Group Therapy Education Group, hereafter referred to as Group 9, had 12 subjects and convened for 13 sessions. During these periods of observation, 143 group surveys were returned that yielded an average group satisfaction mean of 8.25, Standard deviation (St.Dev.) = .67, Standard error of the mean (SEM) = .06, Variance = .45, Skewness = - 1.01, and Kurtosis = .87.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 89, which demonstrates increase in aggregate group satisfaction during the second and third observations with a decrease in the fourth observation and the ninth observation and gradual increase until the thirteenth and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 41 which set the average group satisfaction level for the second observation (Mean = 7.73) and an increase in the third observation (Mean = 8.60) and decrease in the fourth observation (Mean = 8.11) then by the ninth observation another increase starting at (Mean = 7.51) and increasing by the final group session to (Mean = 8.65).

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 90. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 41. Greatest agreement occurs in the eighth, twelfth and thirteenth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 91. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 42. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 43.

Respect, honesty and sharing, show limited variability, while dimensions of leadership, time, cohesion, trust, and comfort show an increasing variability with nearly less proportional contribution of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 92. From this figure Subjects 2 and 4 are represented to have reported lower average satisfaction values and did reach optimum levels during times of observation whereas Subjects 6, 8, 12, 5, 11, 7, 10, 9, 1 and 3 reported optimum levels of satisfaction throughout most of the times of observation, or group sessions other than session 9. The values that correspond with each subject’s data points plotted over time are given in Table 44.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks is illustrated in Figure 93. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 42. The dimension of comfort averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks. All of the dimensions surveyed increased by the last period of observation.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The mean score of average satisfaction and standard deviation is seen in Figure_94 (Mean = 8.25, St. Dev. = .67 and surveys completed N = 143). The histogram indicates skewed and a kurtotic distribution of values.

Scatterplot to Evaluate Linearity Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 95 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence A scatterplot to evaluate the assumption of independence of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .304, R^2 = .092, Adj. R^2 = .086, Std. Error of the Estimate =

.64, Durbin-Watson = 2.034) as seen in the scatterplot in Figure 96. There is no evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does confirms that there is NOT a relationship between adjacent values.

Moving Average Line Graph The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 97. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t7 (times of observation) and t9 (time of observation) may be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 12, $^{r}{}_{F2}$ = -0.0190, Mean = 8.31 $^{t}{}_{F2}$ value = 2.51, DF = 17, p = .022) the autocorrelation values are determined to be significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 41. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 9 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores =8.23), and is further bound by a fixed upper two standard deviation control limit (UCL = 9.16) and a lower two standard deviation control limit (LCL = 7.30) for each group as seen in Figure 98. Values corresponding to the average score per time of observation and score range are available in Table 45.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.34), and is further bound by a fixed upper control limit (UCL = 3.06) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero throughout all 16 groups and is graphically represented for this group in Figure 99. Values corresponding to the average score per time of observation and score range are available in Table 45.

Group 10 Results Summary

The tenth Group Therapy Education Group, hereafter referred to as Group 10, had 19 subjects and convened for 10 sessions. During these periods of observation, 152 group surveys were returned that yielded an average group satisfaction mean of 7.11, Standard deviation (St.Dev.) = 1.76, Standard error of the mean (SEM) = .01, Variance = .45, Skewness = -1.50, and Kurtosis = 2.64.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 100 that demonstrates increase in aggregate group satisfaction during the fourth and seventh observations and the ninth observation and a decrease in the tenth and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 46 which set the average group satisfaction level for the fourth observation (Mean = 8.11) and a decrease followed by another increase in the seventh observation (Mean = 7.48) and increase in the ninth observation (Mean = 8.01) and decreasing in the final group session to (Mean = 7.33).

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 101.

The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 46. Greatest agreement occurs in the seventh, eighth and ninth period of observation.

<u>Area Graph</u> An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 102. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 47. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 48. Leadership, honesty, time, and respect show limited variability, while dimensions of sharing, cohesion, trust, and comfort show an increasing variability with nearly less proportional contribution of dimensions as variation increases.

<u>Three-Dimensional Surface Plot of Individual Subjects</u> The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Figure 103. From this figure nearly all subjects except 10, 13, and 16 are represented to have reported lower average satisfaction values and did reach optimum levels during times of observation.

Subjects 13 and 16 reported optimum levels of satisfaction throughout most of the times of observation. The values that correspond with each subject's data points plotted over time are given in Table 49.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks is illustrated in Figure 104. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 47. The dimension of comfort averaged the lowest values across weeks and the dimension of leadership averaged the highest values across weeks.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The "N" value for this group refers to the number of group surveys included in the group over time rather than the number of participants, as seen in Figure 105 (Mean = 7.11, St. Dev. = 1.76 and surveys completed N = 152). The histogram indicates skewed and a kurtotic distribution of values.

Scatterplot to Evaluate Linearity Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 106 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t).

Model values calculated for the dependent variable of average satisfaction are (R = .029, R^2 = .001, Adj. R^2 = -.006, Std. Error of the Estimate = 1.76, Durbin-Watson = 1.995) as seen in the scatterplot in Figure 107. There is no evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does confirm that there is NOT a relationship between adjacent values.

Moving Average Line Graph The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 108. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t2, t4, t6 (times of observation) and t8 (time of observation) may be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 19, $^{r}{}_{F2}$ = -0.6857, Mean = 7.04 $^{t}{}_{F2}$ value = 3.79, DF = 14, p = .002) the autocorrelation values are determined to be significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 46. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 10 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores =7.14), and is further bound by a fixed upper two standard deviation control limit (UCL = 8.02) and lower two standard deviation control limit (LCL = 6.26) for each group as seen in Figure 109. Values corresponding to the average score per time of observation and score range are available in Table 50.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.41), and is further bound by a fixed upper control limit (UCL = 3.21) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero and is graphically represented for this group in Figure 110. Values corresponding to the average score per time of observation and score range are available in Table 50.

Group 11 Results Summary

The eleventh Group Therapy Education Group, hereafter referred to as Group 11, had 18 subjects and convened for 13 sessions. During these periods of observation, 228 group surveys were returned that yielded an average group satisfaction mean of 7.83, Standard deviation (St.Dev.) = .89, Standard error of the mean (SEM) = .06, Variance = .80, Skewness = -.82, and Kurtosis = .11.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 111 that demonstrates decrease in aggregate group satisfaction during the seventh observation and an increase in the tenth observation with a gradual increase until the thirteenth and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 51 which set the average group satisfaction level for the seventh observation (Mean = 8.16) and a increase followed by another increase in the tenth observation (Mean = 8.08) and increasing in the final group session to (Mean = 8.21).

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 112. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 51. Greatest agreement occurs in the fourth, ninth and thirteenth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 113. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 52. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 53.

Respect, honesty, trust, and, leadership show limited variability, while dimensions of sharing, cohesion, time, and comfort show an increasing variability with nearly less proportional contribution of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 114. From this figure nearly all subjects except 16 and 11 are represented to have reported lower average satisfaction values and did reach optimum levels during times of observation. Subjects 3, 9 and 6 reported optimum levels of satisfaction throughout most of the times of observation. The values that correspond with each subject's data points plotted over time are given in Table 54.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks is illustrated in Figure 115. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. Each dimension is sorted on the sum of the average score of the dimension so that those dimensions rated with higher average values are located more distally or toward the back of the chart field and those dimensions with lesser average values appear more proximally or toward the front of the visual field of the chart. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 52. The dimension of comfort averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The mean score of average satisfaction and standard is seen in Figure 116 (Mean = 7.83, St. Dev. = .89 and surveys completed N = 228). The histogram indicates skewed and a highly kurtotic distribution of values.

Scatterplot to Evaluate Linearity Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 117 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence A scatterplot to evaluate the assumption of independence of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .209, R^2 = .044, Adj. R^2 = -.039, Std. Error of the Estimate = .88, Durbin-Watson = 2.199) as seen in the scatterplot in Figure 118. There is no evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does confirm that there is NOT a relationship between adjacent values.

Moving Average Line Graph The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 119. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t5 (time of observation) and t9 (time of observation) is NOT due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN ${}^{r}{}_{F2}$ method (n= 18, ${}^{r}{}_{F2}$ = 0.4468, Mean = 7.89 ${}^{t}{}_{F2}$ value = 1.92, DF = 17, p = .071) the autocorrelation values are determined to be NOT significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 51. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 11 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores =7.84), and is further bound by a fixed upper two standard deviation control limit (UCL = 9.16) and lower two standard deviation control limit (LCL = 6.52) for each group as seen in Figure 120. Values corresponding to the average score per time of observation and score range are available in Table 55.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.85), and is further bound by a fixed upper control limit (UCL = 4.23) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero throughout all 16 groups and is graphically represented for this group in Figure 121. Values corresponding to the average score per time of observation and score range are available in Table 55.

Group12 Results Summary

The twelfth Group Therapy Education Group, hereafter referred to as Group 12, had 14 subjects and convened for 13 sessions. During these periods of observation, 177 group surveys were returned that yielded an average group satisfaction mean of 8.48, Standard deviation (St.Dev.) = .80, Standard error of the mean (SEM) = .06, Variance = .64, Skewness = -4.231, and Kurtosis = 28.617.

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 122 that demonstrates decrease in aggregate group satisfaction during the third observation and gradual decreases until the ninth observation with gradual increase until the thirteenth and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 56 which set the average group satisfaction level for the third observation (Mean = 8.53) and a decrease in the ninth observation (Mean = 8.31) and increasing in the final group session to (Mean = 8.84).

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 123. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 56. Greatest agreement occurs in the eleventh, twelfth and thirteenth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 124. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 57. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 58. Respect, leadership honesty, and sharing show limited variability, while dimensions of trust, cohesion, time, and comfort show an increasing variability with nearly less proportional contribution of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Figure 125. From this figure nearly all subjects except 12 and 3, and 14 are represented to have reported lower average satisfaction values and did reach optimum levels during times of observation. Subjects 5, 10, 13, 4, and 7 reported optimum levels of satisfaction of score values of between 8 and 9 throughout most of the times of observation. The values that correspond with each subject's data points plotted over time are given in Table 59.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks is illustrated in Figure 126. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter "t" prior to the number of the week of observation. Each dimension is sorted on the sum of the average score of the dimension so that those dimensions rated with higher average values are located more distally or toward the back of the chart field and those dimensions with lesser average values appear more proximally or toward the front of the visual field of the chart. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 57. The dimension of comfort averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The mean score of average satisfaction and standard deviation is seen in Figure 127 (Mean = 8.50, St. Dev. = .80 and surveys completed N = 177). The histogram indicates skewed and a highly kurtotic distribution of values.

Scatterplot to Evaluate Linearity Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 128 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .390, R^2 = .152, Adj. R^2 = 147, Std. Error of the Estimate = .74, Durbin-Watson = 1.850) as seen in the scatterplot in Figure 129. There is no evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does confirm that there is NOT a relationship between adjacent values.

Moving Average Line Graph The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 130. What is most notable about this graphic is that the Intervention Behavior line and the

Intervention Moving Average differences at t5 (time of observation) and t9 (time of observation) is NOT due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 14, $^{r}{}_{F2}$ = 0.7279, Mean = 8.57 $^{t}{}_{F2}$ value = 1.81, DF = 17, p = .088) the autocorrelation values are determined to be NOT significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 56. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

<u>X-Bar R-Chart</u> The X-bar R-chart for Group 12 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores =8.49), and is further bound by a fixed upper two standard deviation control limit (UCL = 9.10) and lower two standard deviation control limit (LCL = 7.88) for each group as seen in Figure 131. Values corresponding to the average score per time of observation and score range are available in Table 60.

<u>R- Chart</u> The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = .90), and is further bound by a fixed upper control limit (UCL = 2.05) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations for each group. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero throughout all 16 groups and is graphically represented for this group in Figure 132. Values corresponding to the average score per time of observation and score range are available in Table 60.

Group 13 Results Summary

The thirteenth Group Therapy Education Group, hereafter referred to as Group 13, had 8 subjects and convened for 13 sessions. During these periods of observation, 96 group surveys were returned that yielded an average group satisfaction mean of 7.49, Standard deviation (St.Dev.) = 1.28, Standard error of the mean (SEM) = .13, Variance = 1.65, Skewness = -.788, and Kurtosis = -.282

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 133 that demonstrates gradual increase in aggregate group satisfaction from the second observation and through the thirteenth and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 61 which set the average group satisfaction level for the second observation (Mean = 6.59) and increasing in the final group session to (Mean = 8.48).

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 134. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 61. Greatest agreement occurs in the fifth, eighth and tenth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 135. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 62. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 63.

Leadership, respect, time, and, honesty show limited variability, while dimensions of trust, sharing, cohesion, and comfort show an increasing variability with nearly less proportional contribution of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Figure 136. From this figure nearly all subjects except 3 and 1, and 5 are represented to have reported lower average satisfaction values and did reach optimum levels during times of observation. Subjects 8, 2, 6, 7 and 4 reported optimum levels of satisfaction throughout most of the times of observation. The values that correspond with each subject's data points plotted over time are given in Table 64.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks is illustrated in Figure 137. Each dimension or survey variable is labeled and the time of observation is represented in sequence with the letter “t” prior to the number of the week of observation. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 62. The dimension of comfort averaged the lowest values across weeks and the dimension of leadership averaged the highest values across weeks.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The mean score of average satisfaction and standard deviation is seen in Figure 138 (Mean = 7.49, St. Dev. = 1.28 and surveys completed N = 96). The histogram indicates skewed distribution of values.

Scatterplot to Evaluate Linearity Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 139 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .404, R^2 = .163, Adj. R^2 = 155, Std. Error of the Estimate = 1.18, Durbin-Watson = 2.759) as seen in the scatterplot in Figure 140. There is no evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does confirm that there is minimally positive relationship between adjacent values.

Moving Average Line Graph The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 141. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t3 (time of observation) and t6 (time of observation) is NOT due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN ${}^{r}{}_{F2}$ method (n= 8, ${}^{r}{}_{F2}$ = 0.6791, Mean = 7.74 ${}^{t}{}_{F2}$ value = 1.53, DF = 14, p = .146) the autocorrelation values are determined to be NOT significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 61. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 13 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 7.52), and is further bound by a fixed upper two standard deviation control limit (UCL = 8.91) and lower two standard deviation control limit (LCL = 6.14) for each group as seen in Figure 142. Values corresponding to the average score per time of observation and score range are available in Table 65.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.95), and is further bound by a fixed upper control limit (UCL = 4.45) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. However, the number of weeks or times of observation differ for each group. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit

(LCL) for the range of scores is zero throughout all 16 groups and is graphically represented for this group in Figure 143. Values corresponding to the average score per time of observation and score range are available in Table 65.

<u>Group 14 Results Summary</u>

The fourteenth Group Therapy Education Group, hereafter referred to as Group 14, had 9 subjects and convened for 14 sessions. During these periods of observation, 122 group surveys were returned that yielded an average group satisfaction mean of 8.48, Standard deviation (St.Dev.) = .60, Standard error of the mean (SEM) = .05, Variance = 3.60, Skewness = -1.128, and Kurtosis = .952

<u>Standard Line Graph</u> The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 144 that demonstrates gradual increase in aggregate group satisfaction from the second observation and through the fourteenth and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 66 which set the average group satisfaction level for the second observation (Mean = 7.81) and increasing in the final group session to (Mean = 8.85).

<u>Standard Deviation Enhanced Line Graph</u> Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 145. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with

the graphed standard deviation data points, per time of observation, are given in Table 66. Greatest agreement occurs in the third, eleventh and fourteenth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 146. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 67. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 68.

Respect, honesty trust, and, leadership show limited variability, while dimensions of sharing, cohesion, comfort, and time show an increasing variability with nearly equivalent proportional contribution of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 147. From this figure subjects 4 and 9 are represented to have reported lower average satisfaction values and did reach optimum levels of average satisfaction score values if between 8 and 9 during times of observation. Subjects 1, 7, and 3 reported optimum levels of satisfaction throughout most of the times of observation. The values that correspond with each subject’s data points plotted over time are given in Table 69.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks is illustrated in Figure 148. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 67. The dimension of time averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The mean score of average satisfaction and standard deviation is seen in Figure 149 (Mean = 8.48, St. Dev. = .60 and surveys completed N = 122). The histogram indicates skewed and highly kurtotic distribution of values.

Scatterplot to Evaluate Linearity Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 150 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .405, R^2 = .164, Adj. R^2 = 157, Std. Error of the Estimate = .551, Durbin-Watson = 1.976) as seen in the scatterplot in Figure 151. There is no evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does confirm that there is minimally positive relationship between adjacent values.

Moving Average Line Graph The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 152. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t5 (time of observation) and t8 (time of observation) is NOT due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 9, $^{r}{}_{F2}$ = 0.8664, Mean = 8.52 $^{t}{}_{F2}$ value = 2.04, DF = 18, p = .055) the autocorrelation values are determined to be NOT significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 66. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 14 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 8.47), and is further bound by a fixed upper two standard deviation control limit (UCL = 9.22) and lower two standard deviation control limit (LCL = 7.73) for each group as seen in Figure 153. Values corresponding to the average score per time of observation and score range are available in Table 70.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.95), and is further bound by fixed upper control limit (UCL = 4.45) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero throughout all 16 groups and is graphically represented for this group in Figure 154. Values corresponding to the average score per time of observation and score range are available in Table 70.

Group 15 Results Summary

The fifteenth Group Therapy Education Group, hereafter referred to as Group 15, had 17 subjects and convened for 12 sessions. During these periods of observation, 186 group surveys were returned that yielded an average group satisfaction mean of 7.41, Standard deviation (St.Dev.) = .08, Standard error of the mean (SEM) = 1.15, Variance = 1.32, Skewness = -.59, and Kurtosis = -.249

Standard Line Graph The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 155 that demonstrates gradual increase in aggregate group satisfaction from the second observation then an increase and following decrease until the seventh observation with another increase and following decrease through the twelfth and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 71 which set the average group satisfaction level for the second observation (Mean = 7.41) and then for the seventh observation (Mean = 6.99) and then in the final group session to (Mean = 7.41).

Standard Deviation Enhanced Line Graph Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 156. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 71. Greatest agreement occurs in the fourth, sixth, and tenth period of observation.

Area Graph An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 157. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 72. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 73.

Respect, honesty, leadership, and time show limited variability, while dimensions of trust, sharing, cohesion, comfort and show an increasing variability with nearly equivalent proportional contribution of dimensions as variation increases.

Three-Dimensional Surface Plot of Individual Subjects The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Figure 158. From this figure subjects 1, 2, 5, 11, 16, 6, 17,10, 13, 4, 12, 8 and 15 are represented to have reported lower average satisfaction values and did reach optimum levels of average score values of between 8 and 9 during times of observation. Subjects 9, 3, 7 and 14 reported optimum levels of satisfaction throughout most of the times of observation. The values that correspond with each subject's data points plotted over time are given in Table 74.

<u>Three-Dimensional Surface Plot of Dimensions of Change</u> The three-dimensional surface plot of dimensions of change across weeks is illustrated in Figure 159. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 72. The dimension of comfort averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks.

<u>Histogram</u> A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The mean score of average satisfaction and standard is seen in Figure 160 (Mean = 7.41, St. Dev. = .08 and surveys completed N = 186). The histogram indicates skewed and highly kurtotic distribution of values.

<u>Scatterplot to Evaluate Linearity</u> Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 161 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

<u>Scatterplot to Evaluate Independence</u> The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .109, R^2 = .012, Adj. R^2 = 006, Std. Error of the Estimate = 1.15, Durbin-Watson = 1.649) as

seen in the scatterplot in Figure 162. There is no evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does confirm that there is NOT a relationship between adjacent values.

Moving Average Line Graph The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 163. What is most notable about this graphic is that the Intervention Behavior line and the Intervention Moving Average differences at t4, t7 (times of observation) and t10 (time of observation) are NOT due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 17, $^{r}{}_{F2}$ = 0.4734, Mean = 7.42 $^{t}{}_{F2}$ value = 1.79, DF = 16, p = .092) the autocorrelation values are determined to be NOT significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 71. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

X-Bar R-Chart The X-bar R-chart for Group 15 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 7.41), and is further bound by a fixed upper two standard deviation control limit (UCL = 8.30) and lower two standard deviation control limit (LCL = 6.53) for each group as seen in Figure 164. Values corresponding to the average score per time of observation and score range are available in Table 75.

R- Chart The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 1.27), and is further bound by a fixed upper control limit (UCL = 2.89) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. However, the number of weeks or times of observation differ for each group. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero throughout all 16 groups and is graphically represented for this group in Figure 165. Values corresponding to the average score per time of observation and score range are available in Table 75.

<u>Group 16 Results Summary</u>

The sixteenth Group Therapy Education Group, hereafter referred to as Group 16, had 16 subjects and convened for 11 sessions. During these periods of observation, 169 group surveys were returned that yielded an average group satisfaction mean of 7.46, Standard deviation (St.Dev.) = 1.28, Standard error of the mean (SEM) = .10, Variance = 1.63, Skewness = -1.287, and Kurtosis = 2.714.

<u>Standard Line Graph</u> The average aggregate level of group satisfaction per time of observation is represented in traditional line graph in Figure 166 that demonstrates gradual increase in aggregate group satisfaction from the second observation through the eleventh and final observation. The values corresponding with the graphed data points of line graph representation are given in Table 76 which set the average group satisfaction level for the second observation (Mean = 7.17) and then in the final group session to (Mean = 7.92).

<u>Standard Deviation Enhanced Line Graph</u> Evaluative information on the level of agreement of group participants relative to perceived group satisfaction, within the group, is illustrated in the Standard Deviation Enhanced Line Graph (SDELG) in Figure 167. The Standard Deviation Enhanced Line Graph (SDELG) visually demonstrates greater

variation at some plotted times of observation and greater group concordance at other plotted times of observation. The graphical representation provides information on the degree of agreement or overall cohesion within the group. The values corresponding with the graphed standard deviation data points, per time of observation, are given in Table 76. Greatest agreement occurs in the second, seventh, and tenth period of observation.

<u>Area Graph</u> An area graph depicting the proportional contribution of each of the survey items or dimensions of group satisfaction is illustrated in Figure 168. Those dimensions having least variability are plotted nearest the X-axis and dimensions with greater variability are plotted higher on the Y-axis. The proportional contribution of each dimension can be determined by estimating the width of the colorized dimension segment for a particular time of observation, or by reviewing the associated table, which presents the corresponding values. The values that correspond with each average dimension of change as plotted over time are given in Table 77. The calculated values are used to evaluate the proportional contribution of dimension of change per time of measurement as represented in the graphic corresponding values given in Table 78. Respect, sharing, trust, and leadership show limited variability, while dimensions of honesty, cohesion, time, and comfort show an increasing variability with nearly equivalent proportional contribution of dimensions as variation increases.

<u>Three-Dimensional Surface Plot of Individual Subjects</u> The three dimensional surface plot of individual subject satisfaction across weeks was constructed in Excel as seen in Figure 169. From this figure subjects 10, 3, 12, 15, 11, 14, 4, 7, and 9 are represented to have reported lower average satisfaction values and did reach optimum levels of average score values of between 8 and 9 during times of observation. Subjects 16, 1, 8, 5, 2, 13

and 6 reported optimum levels of satisfaction throughout most of the times of observation. The values that correspond with each subject's data points plotted over time are given in Table 79.

Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of dimensions of change across weeks is illustrated in Figure 170. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation is given in Table 77. The dimension of comfort averaged the lowest values across weeks and the dimension of respect averaged the highest values across weeks.

Histogram A histogram of the variable of average satisfaction across weeks or at times of observation was constructed to evaluate the normality of distribution of the average satisfaction scores. The mean score of average satisfaction and standard is seen in Figure 171 (Mean = 7.46, St. Dev. = 1.28 and surveys completed N = 169). The histogram indicates a skewed distribution of values.

Scatterplot to Evaluate Linearity Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 172 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Scatterplot to Evaluate Independence The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .367,

R^2 = .134, Adj. R^2 = 129, Std. Error of the Estimate = 1.19, Durbin-Watson = 1.751) as seen in the scatterplot in Figure 173. There is no evidence that the residuals are related to the order to which values were obtained. The Durbin-Watson test does confirm that there is NOT a relationship between adjacent values.

<u>Moving Average Line Graph</u> The intervention behavior and the moving average for the group satisfaction values are represented as lines and are clearly labeled in Figure 174. What is most notable about this graphic is the Intervention Behavior line and the Intervention Moving Average differences at t3, t5 (times of observation) and t8 (time of observation) that may be due to autocorrelation. When this graphic is tested for autocorrelation using the SINGWIN $^{r}{}_{F2}$ method (n= 16, $^{r}{}_{F2}$ = 1.0333, Mean = 7.63 $^{t}{}_{F2}$ value = 2.74, DF = 15, p = .015) the autocorrelation values are determined to be significantly different than zero. The intervention behavior line values per time of observation are the same as the values depicted in the line graph, referred to in Table 76. A table has also been constructed to compare the significance levels for autocorrelation values for all groups and will be referred to in the multiple or all group section.

<u>X-Bar R-Chart</u> The X-bar R-chart for Group 16 depicts the process mean, at times of observation, and compared to the projected average of all scores (Mean of average scores = 7.46), and is further bound by a fixed upper two standard deviation control limit (UCL = 8.94) and lower two standard deviation control limit (LCL = 5.97) for each group as seen in Figure 175. Values corresponding to the average score per time of observation and score range are available in Table 80.

<u>R- Chart</u> The R-chart depicts the range of scores at times of observation, and compared to the projected average of all scores (Mean of average scores = 2.15), and is further bound

by a fixed upper control limit (UCL = 4.90) of two standard deviations and bound by a fixed lower control limit (LCL = 0.00) of two standard deviations. Due to the limited scale of the survey instrument and limited range of scores the lower bound or Lower Control Limit (LCL) for the range of scores is zero throughout all 16 groups and is graphically represented for this group in Figure 176. Values corresponding to the average score per time of observation and score range are available in Table 80.

Graphical Evaluation of Multiple Groups Summary

In evaluating the responses of multiple groups of all subjects through graphical representation, only selected representations were applicable to the task. For instance, a line graph of the average group satisfaction responses for members of the 16 groups, each of varying duration, could be plotted but would likely be confusing and difficult to read. A standard deviation enhanced line graph (SDELG) was not produced for multiple groups due to the differing duration of group sessions. An area graph was not produced as the proportional contributions of groups meeting for a shorter duration would have meant basing the proportions for comparison in later groups on average values calculated from pervious group sessions. A moving average line graph was not produced for multiple groups as the SINGWIN program is designed to evaluate single subject or single group interventions with fewer values, or points of observation. The X-bar-chart and the R chart were designed to evaluate statistical process control when the same conditions are assured for all subjects and would not have applied to groups occurring at differing durations of time or with differing group leaders. Therefore, graphical representations and accompanying tables were produced where additional meaningful information could be extracted from an examination of results and in conformance with the previously stated research goals.

Multiple Groups: Three-Dimensional Surface Plot of Dimensions of Change The three-dimensional surface plot of multiple group dimensions of change across weeks was constructed in the Microsoft Excel program as seen in Figure 177. Each dimension is labeled and the time of observation is represented in sequence with the letter “t” prior to the number of the week of observation. Each dimension is sorted on the sum of the average score of the dimension so that those dimensions rated with higher average values are located more distally or toward the back of the chart field and those dimensions with lesser average values appear more proximally or toward the front of the visual field of the chart. The values that correspond with each survey variable or dimension of change data points plotted over time for this graphical representation are given in Table 81. The dimension of comfort averaged the lowest values across weeks and the dimension of leadership averaged the highest values across weeks.

Multiple Groups: Three Dimensional Surface Plot-Group Satisfaction by Group Leaders The three dimensional surface plot of average group satisfaction across weeks was constructed in Excel as seen in Figure 178. Each group was identified by group number and by a group leader A, B, or C. The group values were sorted based on the highest average group satisfaction achieved. From this figure those groups that met for longer numbers of weeks in general achieved overall higher average group satisfaction values. Group leader A is associated with those groups, in general, of longer duration and having higher average group satisfaction values. Group leader B provided fewer groups and of shorter duration that have middle to lower average group satisfaction values. Whereas, group leader C provided the fewest groups and those meeting for the middle duration with lower mid-range average group satisfaction scores. The values that correspond with each group and group leaders data points plotted over time are given in Table 82.

Multiple Groups: Histogram- Distribution of frequency of average satisfaction A histogram of the variable of average satisfaction across weeks or at times of observation for all groups was constructed to evaluate the normality of distribution of the average satisfaction scores. The "N" value for this group refers to the number of total group surveys included in all groups over time rather than the number of participants, as seen in Figure 179 (Mean = 7.82, St. Dev. = 1.14 and surveys completed N = 2396). The histogram indicates skewed and a highly kurtotic distribution of values.

Multiple Groups (SPSS)-Scatterplot: Predicted and observed group satisfaction values A scatterplot was constructed in SPSS to evaluate predicted and observed group satisfaction values for all groups and to determine whether a linear model would be a good choice with respect to predicting group satisfaction over time. Average satisfaction and time of observation were entered respectively as the dependent and independent variables to create the standardized (ZRESID) and studentized (SRESID) residuals necessary for scatterplot construction. As demonstrated in Figure 180 the distribution of variances does NOT cluster to form a line of equal or nearly equal variances and does NOT support analysis through linear modeling.

Multiple Groups (SPSS)-Scatterplot: Studentized residuals versus order of observations A scatterplot to evaluate the assumption of independence of group sets of observations was constructed in SPSS. The studentized residuals (SRESID) of average satisfaction per time of observation were plotted against the sequence variable of time (t). Model values calculated for the dependent variable of average satisfaction are (R = .000, R^2 = .000, Adj. R^2 = -.000, Std. Error of the Estimate = .00, Durbin-Watson = 1.453) as seen in the scatterplot in Figure 181. There is no evidence that the residuals are related to the order to which values were obtained between groups. The Durbin-Watson test does confirm that there is moderately positive relationship between adjacent group values, however.

Statistical Analysis Summary

Descriptive statistics were computed for each dimension or variable of change measured by the survey instrument. Results indicated that means of some surveyed dimensions of group satisfaction were higher than other dimensions. The mean values for the overall multiple group dimensions were: respect (M = 7.89, SD = 1.62), leadership (M = 7.60, SD = 1.71), honesty (M = 7.62, SD = 1.70), trust (M = 6.70, SD = 1.91), sharing (M = 6.90, SD = 2.00), cohesion (M = 6.70, SD = 1.93), time (M = 7.47, SD = 1.72), and comfort (M = 5.64, SD = 2.34). Dimensions that had higher means were more negatively skewed and demonstrated higher levels of kurtosis, though score values were not normally distributed in all dimensions surveyed (see Table 83).

Missing value analysis A data analysis was performed to determine if any data entry errors had occurred for recorded survey responses. This missing value analysis identified that each of the eight survey variables had one or more missing values. These ranged from one missing score (.0%) to fourteen missing scores (.6%) out of the possible 2397 total scores. As the total number of missing values was less than .01 or (1%) of the total number of possible values, missing values were replaced with the mean score of sample subjects for each item or each dimension where a value was determined to have been missing. This procedure has been considered suitable where the total number of missing values was determined to be less than 1% (or, 41 total missing values) (Cohen & Cohen, 1983).

Kruskal-Wallis H Test The survey data for all 16 groups was compared using a non-parametric procedure to test for differences between groups for several independent samples. The group mean could not be assumed to be the valid center of each group's distribution, therefore test assumptions for analysis of variance procedures were not met. Furthermore, the number of times of observation and number of participants varied per group so that the number of group satisfaction surveys completed was selected as the criteria for determining the mean rank of each group. As the test variable of average group satisfaction was derived from ordinal level data, and an estimate of distances between the values is arbitrary, the Kruskal-Wallace H test procedure was used. The procedure is used to compare group variances by testing the ranks of original values that did not meet the assumptions necessary for parametric testing. The number of surveys completed was used to represent sample values for each group. Percentiles were calculated in quartiles for the 25th (percentile = 7.25), 50th (percentile = 8.13) and 75th (percentile = 8.63) percentile of average satisfaction responses. Then group rank was calculated for all 16 groups and for the 2396 surveys completed for all groups. The Kruskal-Wallis H test then used ranks of the original values, and not the values themselves, to derive a table of mean rank from each group. The mean rank, or the sum of ranks, divided by the number of cases or surveys was computed (see Table 84). The Kruskal-Wallis H statistic measured how much the group ranks differ from the average rank of all groups. Chi–square was used as a test statistic (Chi–square = 326.29, df = 15, Asymptomatic sig. = .000). The asymptotic significance estimates the probability of obtaining a chi-square statistic greater than or equal to the one given, if there truly are no differences between the group ranks.

Summary of hypotheses test results First, to test the hypothesis (H1) that group participant scores would NOT be normally distributed in single groups or in all groups combined, a histogram was produced for each group and all groups combined. Additionally, the level of skewness and kurtosis for average group satisfaction was calculated. These have been presented for each group and all groups combined. Some level of skewness or kurtosis was determined for each of the 16 groups. Histograms were formatted to place all values on the x-axis and y-axis to be the same for all 16 groups and for all groups combined. Values were NOT determined to be normally distributed in single groups or in all groups combined.

Second, to test the hypothesis (H2) that group participant scores would NOT be distributed so as to meet the assumption of linearity in individual groups or in all groups combined, scatterplots were constructed to demonstrate whether the distribution of variances would cluster to form a line of equal or nearly equal variances to support analysis through linear modeling for each of 16 groups and for all groups combined. The scatterplot representations did not support the assumption of homogeneity of variances.

Third, to test the hypothesis (H3) that group participant scores would NOT be independent in individual groups or in all groups combined, scatterplots of average satisfaction per time of observation were plotted against the sequence variable of time for each of 16 groups and all groups combined. There was no evidence that the residuals were related to the order to which values were obtained, or that there was a strong relationship between adjacent values. There was insufficient evidence of independence of observations over time in any of the 16 groups. However, there was no strong relationship between adjacent values. There was some evidence of independence of observations between discrete groups in the scatterplot of observations over time for all groups.

Fourth, to test the hypothesis (H4) that group participant scores would NOT exhibit heterogeneity of variance in distribution descriptive statistics were calculated that suggested variance in measures of central tendency and range of group values. A Kruskal-Wallace H test was then calculated to rank the mean level of surveys completed from among all surveys completed by all groups. The number of surveys was used rather than the number of the subject to give a more accurate ranking of where a group of participants scored as compared to all surveys completed by all groups combined. Differences in these rankings confirm that the group variance is not heterogeneous across groups.

Fifth, to test the hypothesis (H5) that autocorrelation of time series values would occur in each group such that group change as measured by the aggregate dimension of group satisfaction would NOT be statistically significant when tested in the SINGWIN application, average group satisfaction scores per time of observation were entered into the SINGWIN application. The first observation period was entered as the baseline value with following observations entered into the intervention phase. Then, autocorrelation was tested using the r_{F2}/t_{F2} method. A summary of the SINGWIN r_{F2} autocorrelation test for 16 experiential intervention groups is as seen in Table 85. A moving average line of the intervention phase was also produced to represent the differences between recorded values with and without being adjusted to account for autocorrelation. However, in only seven of the sixteen groups was autocorrelation determined to be significantly different than zero.

Finally, to test the hypothesis (H6) that the autoregression term for all time series values would be significant across all groups' data for each dimension of change tested in the SPSS application, an autoregression procedure was completed in the SPSS application for each survey variable with results as summarized in Table 86. Autoregression tests a model of a time series data, in which the current value of the series is a linear combination of previous values of the series, plus a random error.

During the autoregression procedure the starting value for Rho, the autoregressive parameter was set to 0, which was entered as a value into the initial value settings of (Rho) for the SPSS autoregression analysis. This value can be set at any value between -1 and 1. High values of rho are often characteristic of a series in which each data value is likely to be close to the previous value, or with limited variability. Convergence criteria were then entered into the model to allow the specification the criteria used to determine when iteration ceases. The number of iterations was set at 10 iterations.

The independent variables of session number (or group membership), subject number (or participant) and leader number (specific group leader) were entered into each model first and then regressed on the survey variables of time, leadership rating, comfort, trust, respect, honesty, sharing, and cohesion.

Autoregression was determined to be operating for each of the dimensions represented in the survey. The autoregression term was significant across all groups' data for each dimension of change tested in the SPSS application. However, each of the variables, with the exception of time, was determined to be a variable where leader number was found to be a significant variable even though the autocorrelation term was present.

Instrumentation Results Summary

A reliability analysis was conducted to evaluate the consistency of the scale. A covariance matrix was used to determine reliability. An alpha (cronbach) statistic was preferred as a model of internal consistency, based on the average inter-item correlation. An alpha reliability coefficient of .90 was determined with a standardized item alpha of .90 for the eight items contained within the scale using scores from the first administration of the scale and prior to the effect of autocorrelation. The first administration of the survey for all 16 groups was selected, to calculate an initial coefficient alpha. Aggregating survey scores across time for all groups was expected to inflate the estimate of reliability. The overall scale mean and standard deviation were (M = 56.38, SD = 11.61) The mean for specific items was (M = 7.05) with the mean of item variances determined as (M = 3.57). This reliability analysis procedure calculates a number of commonly used measures of scale reliability and was selected to provide information about the relationships between individual items in the scale and the overall reliability of the scale.

A reliability analysis was also completed to determine the change in reliability estimate for values in the study when aggregated across time. An alpha reliability coefficient of .89 was determined with a standardized item alpha of .90 for the eight items contained within the scale. The overall scale mean and standard deviation were (M = 62.57, SD = 9.10) The mean for specific items was (M = 7.82) with the mean of item variances determined as (M = 2.25). The scale reliability estimate remains relatively stable when aggregated across time. The standardized item alpha for the eight items contained within the scale was slightly less and determined to be .89 when calculated for all scores across all times of observation.

Exploratory factor analysis A principal axis factor analysis with promax rotation was performed to determine the number of factors included in the survey instrument. Only one principal component (factor) could be extracted and the solution could not be further rotated. This result suggests that the measurement constitutes a uni-variate assessment of group satisfaction and that scale items are interrelated in the matrix. There were no communalites for any dimension surveyed that exceeded 1.0. Initial eigenvalues indicated that the principle component accounted for more than 54.24 % of the explained variance as seen in Table 87.

A review of eigenvalues from the principal axis factor analysis of the scale indicates that the eigenvalues are not of the same or similar size. Some values appear much larger than others (the time eigenvalue = 4.76) compared to (the cohesion eigenvalue =.18). These indicate a possibility of related variables loading together. Under independence the eigenvalues would be normally distributed, with equal importance, yet under the condition of multicollinearity, the distribution would have a few high eigenvalues and many low ones, reflecting an uneven importance of variables as seen in Table 88.

Scree plot: of factor loading for all survey items- first survey administration (all groups)

A scree plot of the eigenvalues was completed in the SPSS application and graphically depicts the multicollinearity of scale variables. Eight dimensions surveyed load on one factor. The scale measures attributes of a single construct (see the scree plot illustrated in Figure182).

Multicollinearity and singularity are not problematic issues with scale variables. Multicollinearity and singularity may be desired attributes of unidimensional scales. Multicollinearity and singularity are derived from having a correlation matrix with too high of a correlation between variables. Multicollinearity occurs when variables are highly correlated (0.90 and above), and singularity is when the variables are perfectly correlated. Multicollinearity and singularity expose the redundancy of some variables and the potential need to remove variables from the analysis. The higher the multicollinearity, the greater the difficulty in partitioning out the individual effects, of independent variables. However, multicollinearity and singularity of variables suggest that scale variables may be aggregated for unidimensional analysis.

A review of the factor matrix indicates strong factor loadings of .50 or above on all variables suggesting that no variable should be removed from the matrix. Moderately strong factor loadings are noted for the dimensions of leadership, comfort, and time. However, the strongest factor loadings of above .75 are observed for the subjective dimensions of honesty, cohesion, trust, respect, and sharing (see Table 89).

This study's results section has discussed the evaluation of each individual group along with summarized results. In the discussion section to follow, key and unexpected findings will be presented along with the findings derived from the visual comparison of graphical representations or multiple graphical representation comparisons across all groups.

Chapter V:

DISCUSSION AND IMPLICATIONS

Major Study Findings

The range of evaluative graphical representations of multilevel, time series, and multiple group data have been expressed through individual group analysis. These results demonstrate the difficulty of using statistical analysis procedures with practice level data. Individually summarized group results have demonstrated the difficulty in using inferential approaches to group evaluation with non-probability sampling. The phenomenon of autocorrelation mentioned earlier manifests inconsistently across groups and is difficult to graphically identify in this study involving a time series non-random sample of multiple group participants. The SINGWIN application, which has not been widely discussed in the group evaluation literature, has demonstrated the capacity to identify autocorrelation in group single subject evaluation where there are a limited number of observations. This was possible even though autocorrelation cannot be graphically represented using the included graphical representations.

The usefulness of surface plots in detecting and representing multilevel change and simultaneous representation of group process over time and with individual, group, and multiple group outcomes has been demonstrated. Surface plots demonstrated the capacity to provide process understanding in detecting individual variability and variable change in an intervention over time. Both surface plot versions representing individuals and dimensions of change provide the evaluative perspective to identify key changes in variables and participant responses.

Other graphing techniques, such as area graphs, have demonstrated the capacity to evaluate proportional contributions of multiple variable interventions over time. In comparison, the standard deviation enhanced line graph (SDELG) has demonstrated a capacity to determine agreement or cohesion and group turbulence or variability over time. Statistical process control charts, while useful for determining tolerances up to two standard deviations for changes in process mean and range of average group satisfaction scores, demonstrated limited examples of detecting group changes outside the tolerance thresholds. This difficulty suggests that the parameters for tolerance limits may be set too widely to demonstrate exceptions to tolerances, or to pick up the subtleties of process change with a limited number of observations using a non-probability sample of group participants. This difficulty also suggests that no change occurred relative to the capacities of statistical process control charts to detect significant process change. These and other key findings are presented in more detail below.

Graphical Evaluation Techniques

Individual groups were evaluated through a number of graphical representation techniques and statistical procedures to determine the presence or absence of parametric or linear assumptions. These evaluation methods have used a variety of computer applications to assess change per survey variable or dimension of change, individual level change, and group level change. Specific graphical methods have been used to answer, or evaluate, different information needs concerning the quality and reliability of information produced through data visualization methods. Replication of these individual group results as demonstrated in the multiple group graphical representations provides much of the evaluative strength of practice level group data. Trends within groups were compared to other groups. The number of groups unaffected by autocorrelation could be tallied over several iterations of group information to determine the dependability and usefulness of conclusions drawn from repetition of services. Replication of group and other levels of service units is an evaluative strength in the provision of group services and interventions occurring at the level of practice and in education based group services. In this study of repeated experiential group therapy intervention education, the replication of multiple units of graphical representation across periods of observation and across multiple groups has provided more complex graphical representations for group evaluation than previously available for group level single subject design evaluation. Using one or more of these graphical representation approaches contributes to decision maker support for the viability of a group service at the level of practice and the evaluation of process and outcome may also be addressed from multiple perspectives.

The objectives of this graphically intensive methodological study were realized in that a number of methods of evaluating single subject designs for group level data using widely available technology have been identified. These methods have evaluated differing attributes of the data using differing available graphical representations. In addition to Standard Line Graphs used to demonstrate change across time in single subject data, other conventional methods have been demonstrated such as histograms and scatterplots to evaluate whether the data would be best evaluated using research level statistical analysis. Other graphical approaches have been concerned with whether the change observed in graphical representations are likely to be the result of the intervention process or possibly due to autocorrelation occurring in the group demonstrated through the SINGWIN application. Yet some of the graphing approaches demonstrated have focused on uniquely capturing a single aspect of change. For example, a method has been demonstrated using the Standard Deviation Line Graph (SDELG) that captures the visualization of aggregated group scores while simultaneously demonstrating group concordance and variation over time. Whereas, the X-Bar R-Chart and R-Chart approaches to group data evaluation examine whether changes within the group process mean and range of aggregate group scores occur within statistical process control parameters established by available data relative to two standard deviations of change.

Objectives of the study to demonstrate a graphical method to represent multiple dimensions of change over time within a group and to demonstrate a graphical method to visualize attributes of group process and outcome simultaneously, for one or more than one group, have been realized in the presentation of three dimensional surface plots that illustrate multidimensional data over time. An additional method of using area graphs has been demonstrated that represents multiple dimensions of change over time while demonstrating the proportional contribution of variables of change over time and ranking the change variables based on the level of variation per contributing dimension. Then, a three dimensional surface plot representation has been presented that meets the objective of demonstrating a graphical method of representing replication of process and outcome over time and simultaneously for multiple groups of varying duration.

Assessment Evaluation Techniques

The second category of the study objectives focused on the assessment method for determining group therapy education outcomes. Therefore, a reliability coefficient for the measurement instrument was determined that suggests that the instrument is highly reliable in measuring the constructs and variables associated with group satisfaction.

However, in the absence of additional measurement instruments to serve as a reference for the instrument, the validity of the instrument is not known. The determination of therapeutic change factors for each group was evaluated using various single subject graphing approaches. The area graph proved useful in determining which of the change variables per group demonstrated greatest to least variation over the times of observation for each group. Three dimensional surface plots may be also consulted to visually observe which of the dimensions has the highest average score value at points during the process for each group, and those three dimensional surface plots depicting individual subject responses can be consulted to determine which individuals have the highest average group satisfaction level for points of observation in the group process. The histogram demonstrates the problem with normality of data distribution in the absence of traditional research controls and with respect to sample selection. The moving average line graph provides an understanding of score inflation due to auto-correlated error in time series data. Surface plot representations provide illumination with respect to the difficulty of making statistical inferences for group level data where changes have limited statistical conclusion validity.

Data Evaluation Techniques

The third category of study objectives concerned the statistical analysis and measurement limitation issues involved in the evaluation of group therapy education outcomes with a non-probability sample. With respect to hypotheses tested, the data from this non-random sample was found to be not normally distributed, did not support the assumption of linearity, had insufficient evidence of independence of observation for the 16 groups, and had variances found not to be heterogeneous across groups.

Autocorrelation within groups was tested using the *r*f2/*t*f2 method with autocorrelation detected in less than 1/2 of the groups (44%). There is also a lack of independence of observations in several groups, and that this finding may increase the occurrence of Type I or Type II errors in the interpretation of whether the group intervention was effective. Additionally, the graphical representation of moving average line differences did not reflect which of the groups had a significant finding of autocorrelation as the moving average line represents a smoothing effect to adjust for auto-correlated error in time series data. An autoregression procedure was also performed. The procedure confirmed that the autoregression term was significant for the group satisfaction variable for each group. Where the autocorrelation term was present the variable of leader number also was found to be significant.

A Kruskal-Wallace H Test was performed to attempt to provide a ranking of average group responses among the total number of survey responses included in the data. This alternate method for comparing groups other than by group mean was included in the method of this exploratory study. The 16 groups were ranked using the metric derived from the 2396 total surveys completed for all groups. This method permitted greater differentiation among groups than ranking based on the 247 subjects included in the study. Group 3 ranked as highest on this metric while group 4 ranked as the lowest.

Comparison of Groups Summarized

A number of important findings above were clarified in part through the visual comparison of groups by type of graphical representation. All of the individual group graphical representations were visually inspected following the completion of all graphical representations, data analysis techniques and the summarization of all results.

The individual group graphical representations were compared by the types of graphical rendering available. Replicated results could be visually evaluated to determine differences in group results as compared to other groups, and to compare the set of graphical representations for a group to the results obtained from other graphical representation types. The summaries of these observations derived by visual comparison of replicated results by type of graphical representation follow.

Standard Line Graph Comparisons Standard line graphs yield limited evaluative information, but are the most commonly used to evaluate single subject interventions. Line graphs offer an aggregated measure of overall group performance over a series of measurements in time. Any attempt to compare multiple subjects, dimension, or groups, becomes un-interpretable after 6 or 8 lines are added to the graphical representation. Individual graphs may be compared on the amount of visual change noted and the direction of change as compared to the scale variable. Additionally, mid-course changes and the period of observation of change can be compared. For example, a comparison of the 16 line graphs generated for each group illustrates that there was less than one scale unit of positive change in average group satisfaction for groups 4 (9 weeks), 6 (9 weeks), 10 (10 weeks), and 15 (12 weeks), whereas there was approximately one unit of positive change for groups 5 (10 weeks) and 7 (9 weeks), and 11 (13 weeks), and there was one scale unit or greater of positive change for groups 1 (13 weeks), 2 (12 weeks), 3 (11 weeks), 8 (12 weeks), 9 (13 weeks), 12 (13 weeks), 13 (13 weeks), 14 (14 weeks), and 16 (11 weeks). An association between duration of group intervention and degree of positive change can be identified for all groups, but would not be apparent from information given for any one group and could likely be missed. This observation is identified quickly in the surface plot comparison of all 16 groups (Figure: 178). The line graph also depicts areas of average score decrease or troughing of the group progress at various times of observation. That is, each group on average is not as satisfied at various points of observation. These points of observation would be difficult to compare in individual groups.

Standard Deviation Enhanced Line Graph Comparisons The standard deviation enhanced line graph (SDELG) provides additional information on variance and agreement at points of observation. The standard deviation enhanced line graph. An inspection of the 16 individual groups demonstrates each group's greatest period of disagreement or concordance with respect to average group satisfaction. For example, there is a general pattern of closure of variation, or increase in concordance among group participants with respect to perceived average group satisfaction near the end portion of group sessions. In some groups, the greatest period of agreement occurs in the final meeting (groups1, 3, 4, 6, 8, 9 and 11), whereas some groups exhibit one or more periods of maximum concordance prior to the last group session (groups 2, 5, 7, 10, 12, 13, 14, 15, and 16). Then in one instance (group 6), the level of agreement during the last group meeting is approximately the same as in the first group meeting, with the average group satisfaction level being approximately the same as the first session. As the experiential group intervention education survey instrument is designed to evaluate the level of group satisfaction and included dimensions such as group cohesion, trust, sharing, and honesty, then the increased levels of concordance provide an alternative method of evaluating progress toward group goals that is not dependent on increased overall scale value. The points of greatest variation appear to represent points of transition, group turbulence, and disagreement. In general these periods of turbulence are resolved early into the group process, but group member variation or turbulence periods are noted to occur later in several instances (groups 8, 9, 11, 15, and 16). Without additional contextual or process information from these groups, the etiology of the variation is not known.

Area Graph Comparisons Two dimensional area graphs provide an additional evaluative component for the overall assessment of individual groups. That is area graphs can define the driving or contributing dimensional components to a multilevel or multiple dimensional change process. However, area graphs have a limitation similar to standard line graphs in that more than 6 to 8 dimensions or components tend to make the area graph difficult to interpret. When compared, the most stable dimension of group interventions being evaluated may be determined along with those dimensions having the most variation.

For example, the time needed to complete group tasks is the most stable component of group 1, with the variable of honesty being the least consistent over time. The upper bound values over time of the most variable dimension have a similar observable progression to the average values given in the standard line graph over time. However, the standard line graph does not illustrate the proportional contributions of variables or dimensions making up the aggregate score. The area graph though appears to be best suited to representing proportional contributions that vary between times of observation with relatively few input variables over a few observations.

When all 16 area graphs are visually compared, time (groups 1, 4 and 8), comfort (groups 2, 5 and 6), leadership (groups 3, 7, 10 and 13), and perceived respect (groups 9, 11, 12, 14, 15 and 16) are the substrate elements of evaluated group change with the least variation. Those groups reporting respect as the most consistent variable evaluated are associated in general with groups meeting for a greater number of weeks, whereas those citing leadership as the most consistent element tended to be of shorter average duration. The variable of comfort, which is related to the comfort of the physical elements of the group environment is observed to be the most variable contributor to group change for the majority of groups (groups 3, 7, 8, 9, 10, 11, 12, 13, 15, and 16). Thus area graphs demonstrate the potential to evaluate a number of process elements simultaneously with respect to consistency versus variation. Area graphs when compared to the results generated from standard deviation enhanced line graphs provide additional information about the measured variables contribution to agreement or to turbulence within a group. In this instance as all of the dimensions are considered as equivalent contributors, the proportional contributions are visually similar.

<u>Comparison of Surface Plots: Individual Subjects</u> Surface plots or contour plots require some effort on the part of the viewer to determine quantitative relationships between different levels of data. Visualization requires a number of perceptual clues to reveal the three dimensional form for the visual surface. Gridlines are often used to provide an estimation of depth cues for changes in values (Haber, 1988). Therefore, in comparing the 16 surface plots for individuals some information is lost when translating the graphical representation to a print media. In the original computer format, the graphic may be rotated and reoriented to suit the interests of the evaluator. The first observations of note in the print version require some care in determining the visual inspection points of interest in the graphic. The groups' individual participants are recognized by participant number on the x-axis. The times of observation or group sessions are

identified with a “t” by each session number in sequence and the relative value of participant scores is denoted by different color shading for each whole number value. By following the lines of the surface that differentiate the participants and by attending to gridlines and color to determine average satisfaction value per group participant we can begin to evaluate individual average scores within the group. Most notably, there is a general trend of group participants to report increased average group satisfaction later into the group series than earlier. Some surface plots appear less chaotic and more consistent than others indicating consistency among individuals. Those individuals reporting lower average satisfaction are sorted to appear nearer the proximal area of the plane of the surface plot. For example, in groups 1, 2, 4, 5, 6, 7, 10, 11, 13, 15, and 16, one or more subjects can be visually identified who did not report a high average group satisfaction score. Yet, other individuals reported being highly satisfied with the group throughout the group sequence. This observation could prove useful in determining variable associated with less satisfied participants when determining how to select group participants at some future time, or suggest areas for following up with formal confirmatory research. Groups 5, 9, 12, and 14 are noteworthy in that most participants report similar average group satisfaction scores most of the time. In other word, there is both a high level of satisfaction and a high level of participant agreement. As this listing of groups is different than those groups showing agreement in the standard deviation line graph, we can observe which of the group participants are in approximate agreement and then note the few individuals or scores that are not in agreement. We can visually inspect each group to determine which participants account for the variance noted in the standard deviation enhanced line graph (SDELG). Groups 8, 9, 11, 15, and 16 demonstrate a near uniform high level of group satisfaction for all participants by the last few group sessions. This finding is consistent with the observation noted earlier in the standard deviation enhanced line graph (SDELG).

<u>Comparison of Surface Plots: Variables or Dimensions</u> By comparing a set number of variables or dimensions instead of differing numbers of individuals a surface plot can be demonstrated with the same scale dimensions, except for time, or the number of total observations, across all groups. In this instance, eight variables or dimensions of change are rendered for each group. Groups 4, 7 and 10 are noteworthy in that the average of most dimensions of satisfaction are rated lower in the final session than at some earlier point. A different group leader conducted each of these groups. However, all of the groups were abbreviated in the number of total group sessions conducted. The range of weekly group meetings conducted varied from as few as 8 meetings to as many as 14 meetings. These three groups (4, 7, and 10) met for 8 or 10 weeks each. In the case of group 4, the average scores of most of the represented dimensions of change illustrate an absence of the visible score extremes associated with high and low score values as seen in the initial group sessions of most other groups. Group 4 appeared to demonstrate a higher level of stability over time among participants surveyed for the variables of change measured.

<u>Comparison of Histograms: Normality Assumption</u> Histograms for all 16 groups graphically depicted a negatively skewed distribution of scores of average satisfaction with variable levels of kurtosis and with the number of surveys per group ranging from 96 to 248 total surveys. The range for group means was from 7.11(group 10) to 8.5 (group 12) and standard deviation from .60 (group 14) to 1.76 (group10). As the

distribution of each group was uni-modal in nature and nearly all scores were above the mean of 4.5 for the survey instrument. Data were not normally distributed in all 16 groups. Therefore, inferential statistical evaluation that would rely on an assumption of normality of distribution of values or a bimodal distribution of values would not be valid. In other words, there would be a limited validity to inferences made from the responses of these group samples to any larger population.

<u>Comparison of Scatterplots: Linearity Assumption</u> The scatterplots generated for the 16 groups that hypothesized a model based on the predicted and observed group satisfaction values were compared. In general, plotted values did not cluster to form a line of associated distribution of values. The direction of the correlated values for the hypothesized model was slightly negative for all groups. In groups 1, 3, 5 and 12 values were clustered so as to visually appear somewhat linear but not symmetrically distributed. The assumption of linearity or that a linear model could be proposed to predict future values could not be met. Therefore, inferential statistical evaluation that would rely on an assumption of linearity of distribution of values would not be valid. In other words, observed group values are not likely to be associated so as to determine a linear relationship with predicted values.

<u>Comparison of Scatterplots: Independence Assumption</u> The scatterplots generated for the 16 groups that hypothesized a model based on the studentized residuals versus the order of observation of group satisfaction values were compared. In general, plotted values did not cluster to form a line to suggest independence of observation in the distribution of values. In groups 1, 3, 5 and 12 values were clustered so as to visually appear somewhat linear but not symmetrically distributed suggesting that the order of observations would

not make a good predictor of future values. The assumption of independence of observations among group participants could not be met. Therefore, inferential statistical evaluation that would rely on an assumption of independence of observation in the distribution of values would not be valid.

<u>Comparison of Moving Average Line Charts</u> The moving average line graphs constructed in the SINGWIN application were compared for all 16 groups. Graphical representations for groups 6, 8, 9 and10 depicted a visually detectable difference between the intervention behavior line for subjects and the constructed moving average line based on the rf2/*t*f2 autocorrelation procedure. The detection of autocorrelation through visual inspection of the SINGWIN moving average line graphical representations compared to the intervention behavior line was inconsistent. That is, autocorrelation was detected in 44% of the 16 groups but could not be visually determined through inspection of the compared behavioral intervention and moving average lines for all groups.

<u>Comparisons of X-Bar R-Charts</u> The X-bar R-Charts for the 16 groups were compared. In general there was an increase in group process mean for group satisfaction of all groups between initial time of observation and last time of observation. However groups 5, 6, 10, 15 and 16 demonstrated highest process mean scores prior to the last time of observation. In group 10 the process mean exceeded the upper bound statistical process control threshold in the 4th observation of 10 observations. X-Bar R-Charts provided information similar to traditional line graphs with the additional property of providing statistical process control limits of two standard deviations. The statistical group satisfaction mean exceeding the upper bound criteria for average group satisfaction, suggests a highly atypical level of group satisfaction for the time of measurement.

Comparisons of R-Charts Finally, the R-Charts for the 16 groups were visually inspected and compared. Although the range of scores varied for each group, the change in range fell below the lower bound process control threshold for all groups by completion of times of observation for each group. This is consistent with the finding of increased concordance among participants by completion of the group as depicted earlier in the Standard Deviation Enhanced line Graph (SDELG). However, the R-Chart does not capture the dimensions of variation, difference, or group turbulence noted in the Standard Deviation Enhanced Line Graph (SDELG). The R-Chart does indicate that the range of score reduction could be problematic if a specified process control threshold for range of average scores for group satisfaction were desired as an intervention outcome.

Discussion of Unexpected Findings and Limitations

The study relied on a convenience sample in which the independence of observations among subjects could not be assured. This characteristic is common to group treatment evaluation in most mental health practice settings. Subjects cannot be randomly assigned in part due to ethical and practice intervention considerations. Non-independence of observations in this instance is a design issue. However, this would also be considered a sampling issue and often the norm for educational and intervention groups situated in agency practice settings. Furthermore, the evaluation instrument was limited to ordinal scale data. Many of the respondent scores occurred in the narrow range, which constrained the variation in range of values available for evaluation. A trend line could have been plotted which would show a slight positive association between time in the group and satisfaction. This study was less concerned with prediction within a group over time than the comparison of process and outcome at multiple units of analysis simultaneously. Statistical assumptions of independence and normality could not be assured. These factors, along with the data constraints described above, made the use of ordinary least squares regression analysis impractical and unlikely to yield significant predictive results. However, the data visualization procedures included in this study demonstrate the capacity to generalize from results based upon replication across participants, across weeks, across dimensions, and across multiple groups. The research literature has previously demonstrated the overall effectiveness of groups. What are needed however, are mechanisms of evaluating process and outcome for specific groups using single case design methodology at the level of practice. Three procedures, the Standard Deviation Line Graph, the area graph and the three dimensional surface plot have been demonstrated in this study that met this methodological deficit.

However, despite the graphical evaluation approaches demonstrated, there were a number of design limitations inherent in the study. Limitations of this study related to research design issues included: (a.) ordinal level, multi-categorical Likert scale data collected, (b.) a single survey instrument used, (c.) convenience sampling (non-probability), (d.) non-independence of time-series score values, and (e.) the difficulty in evaluating data at multiple units of analysis over time.

Separate from these limitations though, a number of unexpected findings were generated from this exploratory study. Most notable was the emergence of an unanticipated substantive question arising from the replicated group results of average satisfaction across weeks. In the multiple groups three dimensional surface plot, groups were numbered and compared so that groups of shorter numbers of times of observation were sorted toward the proximal or foreground of the graph in Figure 178. Surprisingly, groups meeting for less weeks did not achieve levels of collective average satisfaction levels of between 8 and 9 whereas, group participants of longer numbers of sessions were observed to generally conclude their groups with high average levels of satisfaction. This observation would suggest that groups of shorter duration or total numbers of meetings may not be as likely to experience or report high levels of group satisfaction. That is, that the group process may simply take as long as the group process takes to assure high participant satisfaction, and that attempts to abbreviate or shorten the group experience may leave participants with a more negative experience. Further investigation would likely add valuable knowledge on group process and outcome with respect to number of sessions associated with optimal group satisfaction.

Another unexpected finding is that even though the group data for individual groups did not meet statistical assumptions required for parametric or linear analysis, that autocorrelation was significant in less than half of the 16 groups for average group satisfaction in the intervention phase of the group. This was likely related to the small number of observations in the groups evaluated and would be expected to affect additional groups with the addition of a greater number of observations. Furthermore, the moving average line graph produced in the SINGWIN application represented the differences due to autocorrelation consistently with the exception of one group. For group 16, the moving average line graph did NOT represent a discernable visual difference between the intervention line and the moving average line even though a statistically significant autocorrelation occurred. This phenomenon of difficulty in the determination of autocorrelation through the evaluation of single subject behavioral analysis has been previously reported. Non-parametric procedures and mathematical techniques that utilize recently developed increased computing power have been recommended to augment but not replace visual inspection of single subject behavioral data (Fisch, 2001). Visual inspection of behavioral data cannot be relied on as the sole mechanism of determining intervention efficacy. However, limitations of statistical conclusion validity in single subject designs using limited sampling controls also argues against exclusive reliance on inferential techniques without the inclusion of research or statistical strategies to attempt to control for sampling limitations (Orme, 1991).

A visual comparison of standard deviation enhanced line graphs (SDELG) a three dimensional surface plot of dimensions of change across weeks revealed an association between the two graphics capacity to detect group variation or group turbulence over time. The primary difference between the two graphics was that the Standard Deviation Enhanced Line Graph (SDELG) was limited to observation of change in average group satisfaction whereas the Three-dimensional surface plot demonstrated the turbulence across several variables. Additional visual comparisons to include the moving average line graph were inconsistent in their graphical capacity to reliably detect the presence of significant autocorrelation or the Kruskal-Wallace H Test Ranking of the Group based on the presence or absence of group turbulence.

Limitations of Graphical Methods

Graphical representation requires some minimal orientation from the evaluator to begin to accurately interpret graphed results. Some types of graphs are in common usage and are more familiar to the evaluator. Others such as three-dimensional surface plots require some additional practice and orientation to interpret. However, more advanced graphical representations have evaluative capacities not available in some graphs that are more commonly used. Depending on the problem being evaluated, graphical methods are not always an effective solution nor a substitute for conventional numerical analytical tools (Robinson, Sale, Morrison, & Muehrcke, 1985; Monmonier, 1991; MacEachren, 1994).

For instance a graph may not permit an accurate read of the numerical values associated with a data point without an accompanying table. Graphical representations permit comparisons and illustrate proportions, but do not provide a method to determine statistical significance without further information. Therefore, graphical methods are open to misinterpretation. Yet, statistical values are also open to differing interpretations depending on which analytic techniques and measures are presented. Interpretation may vary more if the evaluator is a practitioner or agency based decision maker unfamiliar with the interpretation of statistical information.

Data visualization through graphical representation permits data exploration through illustrative tools that allow identification of relationships, and patterns we might otherwise miss. However, graphical representation provides no final assurance that the pattern observed is real, or meets the criteria for making inferences based on assumptions about the data used to create the graph. Additional tables of data and additional statistical analysis are required to verify the statistical utility of graphical representations

Some graphical methods serve to provide tangible information that is new or novel, whereas other graphical methods serve to confirm our assumptions about the nature of the data being explored. Other data analysis methods confirm the poor statistical conclusion validity in single subject design studies without probability sampling, or referent control groups. The testing of statistical assumptions serves to provide a measure of security that evaluation must of necessity be limited to non-parametric or descriptive exploratory data analysis methods. Such is the case with the current data examples.

Other graphical methods when presented with limitations clearly stated or understood serve to generate new data insights through representing attributes of the data in new or less familiar ways. These methods serve to tell us something new or not previously observed. Standard deviation enhanced line graphs, area graphs, and three-dimensional surface plots when rendered in as scientific way as possible provide an exploration of the data to generate and present new information. With these exploratory graphical representations, hard statistical conclusion validity is less likely, though the generation of new substantive questions, evaluative decision making support and the discovery of previously unobserved data variation is more likely. These in turn will likely lead to additional conventional research to confirm findings.

Criteria for Determining Usefulness

Graphical representations produced in this study may be categorized based on a number of practical considerations. Initial criteria could be established based on the availability of the application to practitioners, ease of construction of the graphical representation, and a description of the type(s) of information conveyed by the graphic. Additionally, established conventions related to formatting and using the graphic as available in the relevant literature would be useful in providing guidelines for utilization. As this study is exploratory and descriptive in nature, confirmation of utility of a specified graphical representation in practice settings will be deferred for future research. However, the criteria presented in this study have been formatted into a reference table to provide guidelines that would enable the practitioner to select a data visualization approach for an applied group service evaluative need. These have been formatted to present the relevant features and usage of guidelines for graphical representations and may be reviewed in Table 90.

Data Visualization Utility

Utility may be simply and operationally defined as an application, or procedure, that provides an addition to the evaluative capabilities of agency based decision makers and practitioners. By this definition the data visualization examples provided here will provide rapidly produced and reliable methods of evaluating complex data sets using widely available technology. Utility concerns that property in any object or process that tends to a produce benefit or an advantage to individuals, groups, or populations, and have the capacity to prevent harm, or negative consequences from occurring. The utility of a research application, a graphical representation, or use of a computerized application is related to the capacity of the application to use findings from research or evaluation efforts to inform or guide practice. Data visualization techniques clearly have the capacity for practice utility. However, utility is also concerned with the degree to which decision makers and evaluators as well as practitioners accept and begin to include data visualization methods into service and intervention provision. This exploratory study does not resolve these utilization issues that will require additional field level investigation. The questions of acceptance and ease of use must be deferred here pending further study.

There are a number of advantages in terms of potential utility of data visualization methods presented here for practitioners and agency based decision makers. Most importantly is the role of graphical representation in the evaluation of replicated group services over time. That is, that services provided in the absence of strong research protocols are capable of generating reliable evaluative information based on a replication of trends and outcomes over time. Replication of services is an evaluative strength of practice based services that have the capacity of compensating for some common threats to the external validity of the sample under review, and demonstrates a reliability born of replication under a variety of service conditions. Despite the limitations of sample selection, consistent outcomes surveyed and endorsed by group participants across numerous service conditions are capable of providing preliminary evaluative information and providing the observation base to generate new substantive questions of interest to practitioners and researchers. Data visualization methods offer the advantages of conveying information in a rapidly digestible format for those needing to make modifications quickly in ever changing service environments. Furthermore, a number of widely available computer application generated data visualization methods offer multi-analytic advantages for both practitioner and researcher. An example is seen in the three dimensional surface plot which is capable of capturing both process and outcome indicators simultaneously while tracking information at the level of analysis of individual, dimension of change, group leader, and multiple groups in comparison.

Rules for Displaying and Interpreting Presented Graphics

Accepted conventions for the display of graphical representations are in part determined by the distribution medium selected to convey or disseminate graphical information. For instance preferences of aspect ratio are often determined by the viewing format in which the information is displayed. Some aspect ratios' are selected for graphics that will be viewed on a particular media such as a computer monitor, whereas others are best suited to a television monitor, or a particular print media. Printed media such as professional or scholarly journals often suggest formatting guidelines that are conducive to black and white print media and graphic sizes that are preferred for limited column space. Therefore graphics, much like any evaluative information, are subject to manipulation by the evaluator that can lead to erroneous conclusions. Evaluators and those who publish evaluative information should be clear about the type and limitations of the information conveyed and the rationale for selecting a particular graphic including making adjustments to scale, interval, or ratio of comparison. Additionally, when known, information on the validity of statistical conclusions, and summary data of graphical values should be presented to reduce the risk of making false inferences.

There are a number of sources for determining the accepted rules and conventions associated with the display of graphical representation and data visualization approaches to data interpretation and analysis. Some of these sources are The American Statistical Association Style Guide (2002) and the Publication Manual of the American Psychological Association (1997). These are concerned with those conventions associated with basic document preparation and formatting conventions. Formatting conventions include font size, abbreviation styles, preparing tables, figures, figure captions, and the display of mathematical material. However, a number of scientific and research scholars have been concerned with the more difficult to define concept of graphical qualities needed to convey important information within complex data sets.

Some of the basic rules for graphically representing complex information have been articulated by Tufte (1990). These include: (a) perspective drawing methods, such as the construction of three-dimensional models, stereo illustration multiple diagrams indexed on time, or graphical timetables; (b) using small multiples and avoiding “chart-junk,” reporting immense detail through multiple of hierarchical layers of contextual reading; (c) using layers and separation by differentiating with color annotations, maintaining proportion and harmony, toning down backgrounds and use of white-space for pattern recognition; and (d) using colors as labels (differentiating elements) and as measures (in differentiating values: altitude, contour, rate of change).

Tufte (1990) has also proposed four basic color rules to improve the visual understanding of graphically represented data. Color is increasingly a factor in the decision to present graphical information. The color rules as proposed by Tufte are: (a) using bright or strong colors sparingly, (b) avoiding placing white and bright colors next to each other, (c) keeping area background colors quiet (i.e., grey) and then keeping bright areas scaled smaller so that they tend to stand out, and (d) disaggregating and re-iteratation of colors in large fields to create differentiation.

In addition to these well-stated conventions concerning the creation and display of graphical representations there are a number of principles or rules that determine the type and illustration preferences for a particular problem. Decisions about the choice of best graphical representation for a particular evaluative or research issue is in part determined by the number of variable to be presented and the level of differentiation, categorization, or noise preferred and the level of continuity or smoothing preferred. For example, single variable graphs tend to include, bar graphs, histograms, and stem and leaf plots that provide a series of scaled categories of change for comparison. Two variable graphical representations such as scatter-plots are often selected to illustrate the level of association or relationship between the two variables with some measure of magnitude of the relationship. Three or more variables provide a level of complexity of evaluation that has a number of resolutions. When a level of smoothing is desired to show over all trends, the three-dimensional surface plot will likely be preferred. Other approaches tend to include a series of replicated images such as histograms, bar graphs, or scatterplots to demonstrate and visually compare levels of categorical differentiation, or bi-variate relatedness across a series of separate samples. Both of these approaches have been utilized in this study to demonstrate the advantages and disadvantages of each graphical representation depending on the evaluative issue or research question being assessed (Tukey & Tukey, 1988a; Tukey, 1988b; Yu, 1995b).

Although graphical representations have numerous other rules specific to the formation of a particular graph, or to a particular problem such as the volumetric problems associated with scientific visualization, Tukey (1988c) has stated five principles of graphical presentation as follows:

1. There is always a reference, implicit or explicit for what is plotted. Even if points appear by themselves, the brain will invent something for which to compare them.
2. The only really practical and fully satisfactory reference is a straight line – or a family of straight lines. There is nothing else with regard to which the eye is as effective in either implicit or explicit comparison.
3. Horizontal lines are more useful as references than tilted lines both because horizontalness is better judged and because they often allow opening up of vertical scales. In view of the second point, having reference curves nearly horizontal helps.

> 4. Noteworthy alterations in the situation should make noticeable changes in the plot. Indeed, to the greatest extent possible appearance should reflect importance.
>
> 5. If more than points (and comparison curves) are plotted, the eye will seize an area, rather than length or width, as a measure of importance. (p.5)

That is to say more simply, that points of data need to be compared or have references when graphically depicted. Furthermore, a line is a useful method for indicating change and horizontal lines are considered for the eye to interpret with respect to change. A change in situation or condition imposed during a period of intervention or evaluation should be represented in some way in the plot or graph. An area of a plot or graphical representation if left blank will be interpreted as important in some way when compared to the length or width of a representation. Therefore, accompanying data or labels may be necessary to identify the relevant or important aspects of a graphical representation if large unspecified areas are present in the representation. In this study the computer applications graphing software has the capability for correcting labeling and differentiating the attributes of a scale or axis, or for particular variables and areas of interest.

Implications/Applications for Practice

Social Workers and those providing public services to large populations such as public health programs are in need of developing practice accountability strategies to evaluate group services. Computer applications are increasingly playing a role in information management to allocate and distribute goods and services. The provision of a minimum standard of living, a minimum quality of life, and equity in the distribution of supports necessary for human functioning and development are at the core of the mission of professional social work and professional health service provision. Methods to assure that service recipients of group services are well suited to the service and making expected progress toward desired outcomes is needed. Furthermore, a method of evaluating group service and intervention outcomes that is continuous and not reliant on pre and post measurements would be a useful addition to group evaluation. Decisions and changes in service programs must be made rapidly and on credible evaluation methods. Graphical representation approaches that demonstrate the levels of agreement and turbulence among group participants that illustrate the proportional contribution of differing inputs into the intervention and that can make multi-level comparisons between replicated group interventions provide a range of needed evaluative tools. From the public health perspective, group interventions may be evaluated on a number of relevant axes to include risk taking, or compliance behaviors for groups and populations to better rapidly evaluate the affect of preventative, primary, or secondary interventions among at risk groups or populations in need of meeting community health promotion goals. Data visualization methods are needed to assist policy reviewers and decision makers in making optimal use of available resources and intervening early when the group process is not meeting expected outcomes.

Concluding Statement

The correct answer for any problem that involves the analysis of human problems is not a numerical one. A single graphical representation is also unlikely to provide definitive conclusions. Each problem must be explored through a specific context that requires an evaluation of the central issues. Graphical representation and data visualization methods provide the technology needed to explore complex data sets when there are limitations to sampling, statistical assumption criteria in the data collection, or rigorous research controls. Systematic and informed data visualization techniques permit communication of evaluative findings in ways that are rapidly discernable by those who do not have advanced technical training. Technology and the recent advances of technology have made the conveyance, understanding, and dissemination of complex information possible through means of a graphical interface, which became available in many computer applications during the middle of the last decade. This graphical interface has provided new digital tools for the practitioner, so that more effective information and resource management is possible in meeting ever-growing demands for human and public health services. Monitoring of the quality and effectiveness of services though spreadsheet programs has become widely available and provides the graphical formats to evaluate a variety of multi-level and complex service delivery issues for practitioners and human service decision makers within agency settings.

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APPENDICES

Appendix A: Tables

Table 1

Group 1: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
(+) 1 St. Dev.	8.50	8.62	7.94	7.91	8.42	7.86	8.44	8.59	8.64	8.77	8.92	8.87	8.84
Average Satisfaction	7.62	8.17	7.08	6.97	7.39	7.56	8.09	8.16	8.33	8.24	8.42	8.56	8.70
(-) 1 St. Dev.	6.74	7.72	6.22	6.03	6.35	7.27	7.74	7.72	8.02	7.72	7.92	8.25	8.55
St. Dev.	0.88	0.45	0.86	0.94	1.04	0.29	0.35	0.44	0.31	0.53	0.50	0.31	0.14

St. Dev. = Standard Deviation

Table 2

Group 1: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average of Time	7.86	7.68	7.71	7.60	7.71	7.35	8.05	7.40	8.05	8.47	8.40	8.25	8.50
Average of Leadership	7.76	8.28	8.19	8.30	7.81	7.80	8.60	8.55	8.50	8.47	8.60	8.42	8.86
Average of Comfort	5.76	7.37	5.33	5.35	4.86	7.20	7.45	7.55	7.70	7.00	7.20	8.00	8.50
Average of Trust	7.38	8.11	7.05	6.05	7.71	7.45	7.85	8.20	8.35	8.26	8.60	8.75	8.86
Average of Respect	8.67	8.74	7.14	7.70	7.90	8.05	8.40	8.55	8.60	8.74	8.70	8.92	8.71
Average of Honesty	8.38	8.58	7.57	7.10	8.05	7.80	8.20	8.35	8.50	8.42	8.75	8.67	8.79
Average of Sharing	7.81	8.26	7.00	6.80	7.52	7.30	7.95	8.30	8.40	8.32	8.55	8.75	8.64
Average of Cohesion	7.33	8.32	6.62	6.85	7.52	7.55	8.20	8.35	8.55	8.26	8.55	8.75	8.71

Table 3

Group 1: Area Graph -Proportional Contribution of Dimension Per Time of Measurement.

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Time	0.96	0.97	0.79	0.86	0.88	0.89	0.93	0.95	0.96	0.97	0.97	0.99	0.97
Cohesion	0.86	0.92	0.91	0.92	0.87	0.87	0.96	0.95	0.94	0.94	0.96	0.94	0.98
Sharing	0.93	0.95	0.84	0.79	0.89	0.87	0.91	0.93	0.94	0.94	0.97	0.96	0.98
Leadership	0.87	0.92	0.78	0.76	0.84	0.81	0.88	0.92	0.93	0.92	0.95	0.97	0.96
Comfort	0.81	0.92	0.74	0.76	0.84	0.84	0.91	0.93	0.95	0.92	0.95	0.97	0.97
Trust	0.87	0.85	0.86	0.84	0.86	0.82	0.89	0.82	0.89	0.94	0.93	0.92	0.94
Respect	0.82	0.90	0.78	0.67	0.86	0.83	0.87	0.91	0.93	0.92	0.96	0.97	0.98
Honesty	0.64	0.82	0.59	0.59	0.54	0.80	0.83	0.84	0.86	0.78	0.80	0.89	0.94

Table 4

Group 1: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
1	8.88	8.00	8.75	8.75	8.63	9.00	9.00	8.50	8.63	8.75	8.50	8.67	8.63
2	7.38	7.63	8.00	7.13	7.13	8.00	7.75	7.78	8.00	7.38	8.25	9.00	7.78
3	7.13	8.75	9.00	8.50	7.25	8.00	8.38	8.25	8.00	9.00	8.00	8.00	8.19
4	6.75	7.50	7.63	7.88	7.63	8.75	8.00	7.88	8.38	8.38	8.38	8.50	8.75
5	7.25	8.38	6.50	6.88	8.25	8.75	8.63	8.88	8.63	8.17	8.88	8.17	8.88
6	7.88	7.88	8.13	6.50	6.63	8.25	8.50	8.25	8.38	8.25	7.50	7.83	7.83
7	8.63	8.25	8.00	7.63	7.25	7.63	7.75	8.25	7.50	8.00	7.88	8.75	7.96
8	7.50	7.50	6.25	7.13	7.13	8.00	8.25	8.13	8.38	8.38	8.13	8.25	8.25
9	7.25	7.50	7.00	6.75	6.75	6.25	6.25	7.25	8.13	7.25	8.00	8.88	8.63
10	8.25	8.00	7.63	7.13	7.25	7.82	8.25	6.38	7.38	7.82	9.00	7.88	8.88
11	9.00	9.00	5.75	7.75	8.75	1.00	9.00	9.00	8.88	8.88	9.00	7.89	8.63
12	6.88	8.00	7.75	6.38	7.13	8.50	8.00	8.38	9.00	8.38	8.63	7.89	9.00
13	9.00	8.50	3.00	6.00	7.50	8.25	8.63	8.75	9.00	9.00	9.00	8.88	8.88
14	5.88	7.25	4.63	4.38	5.88	6.38	5.75	7.25	7.88	6.63	8.25	8.25	6.53
15	8.50	8.75	7.75	7.75	8.13	8.00	8.50	8.88	8.13	8.63	8.88	9.00	8.88
16	7.13	8.13	7.13	5.88	7.13	8.13	7.63	8.25	9.00	7.73	8.88	7.73	7.73
17	8.25	8.25	6.75	8.63	7.25	8.75	8.50	8.50	8.88	8.75	8.63	8.38	8.29
18	5.38	8.00	4.75	6.25	7.00	6.88	7.75	7.38	7.38	6.50	7.38	6.83	7.38
19	7.88	9.00	7.75	7.00	8.00	7.88	7.88	7.75	8.25	8.00	8.38	9.00	9.00
20	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
21	7.75	8.88	9.00	5.13	8.63	8.00	8.88	8.50	8.88	9.00	8.33	8.33	9.00
22	7.50	7.96	7.50	7.96	5.88	6.88	8.50	8.75	7.96	8.75	8.88	7.96	9.00

Table 5

<u>Group 1: X-Bar-R Chart and R Chart- Mean Values and Range Per Time of Observation</u>

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average score	7.62	8.17	7.08	6.97	7.39	7.56	8.09	8.16	8.33	8.24	8.42	8.56	8.70
Range	2.90	1.37	2.86	2.95	3.19	0.85	1.15	1.15	0.90	1.74	1.55	0.92	0.36

Table 6

Group 2: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
(+) 1 St. Dev.	7.51	7.81	7.93	8.64	8.35	8.07	8.17	8.23	8.26	8.58	8.44	8.60
Average Satisfaction	7.04	7.22	7.52	8.04	7.74	7.92	7.84	7.64	7.87	8.23	8.06	8.45
(-) 1 St. Dev.	6.56	6.63	7.10	7.45	7.13	7.76	7.50	7.06	7.47	7.88	7.69	8.30
St. Dev.	0.44	0.52	0.45	0.58	0.37	0.17	0.33	0.47	0.25	0.38	0.22	0.15

St. Dev. = Standard Deviation

Table 7

Group 2: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
Average of Time	7.79	7.31	6.77	7.58	7.36	7.83	7.23	6.92	7.77	7.54	8.00	8.25
Average of Leadership	7.07	7.31	7.23	7.17	7.50	7.75	7.92	7.77	7.92	8.08	8.07	8.33
Average of Comfort	6.43	6.38	7.54	7.42	6.50	7.92	7.46	6.69	7.08	8.08	7.29	8.33
Average of Trust	6.64	6.69	7.77	8.33	7.86	7.83	8.00	7.69	7.92	8.62	8.00	8.33
Average of Respect	7.29	8.31	8.08	8.75	8.29	8.17	8.31	8.38	8.46	8.62	8.21	8.58
Average of Honesty	7.36	7.62	7.92	8.67	8.29	8.00	8.00	8.08	7.77	8.38	8.57	8.58
Average of Sharing	7.21	7.23	7.46	8.42	8.14	7.75	7.92	7.54	7.85	8.15	8.36	8.58
Average of Cohesion	6.50	6.92	7.38	8.00	8.00	8.08	7.85	8.08	8.15	8.38	8.00	8.58

Table 8

Group 2: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
Comfort	0.81	0.92	0.90	0.97	0.92	0.91	0.92	0.93	0.94	0.96	0.91	0.95
Cohesion	0.82	0.85	0.88	0.96	0.92	0.89	0.89	0.90	0.86	0.93	0.95	0.95
Trust	0.80	0.80	0.83	0.94	0.90	0.86	0.88	0.84	0.87	0.91	0.93	0.95
Sharing	0.72	0.77	0.82	0.89	0.89	0.90	0.87	0.90	0.91	0.93	0.89	0.95
Time	0.74	0.74	0.86	0.93	0.87	0.87	0.89	0.85	0.88	0.96	0.89	0.93
Leadership	0.79	0.81	0.80	0.80	0.83	0.86	0.88	0.86	0.88	0.90	0.90	0.93
Honesty	0.87	0.81	0.75	0.84	0.82	0.87	0.80	0.77	0.86	0.84	0.89	0.92
Respect	0.71	0.71	0.84	0.82	0.72	0.88	0.83	0.74	0.79	0.90	0.81	0.93

Table 9

Group 2: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t5	t5	t6	t7	t8	t9	t10	t11	t12
1	8.63	8.75	8.63	8.51	8.63	8.75	8.88	6.38	8.88	8.63	8.50	9.00
2	5.38	6.13	8.75	7.75	7.75	6.00	6.50	6.63	7.38	7.25	8.00	7.00
3	8.63	7.88	8.38	8.38	7.13	8.38	8.63	8.38	7.88	8.75	7.88	9.00
4	7.88	8.25	8.25	9.00	8.63	9.00	9.00	8.42	7.75	8.25	8.25	8.38
5	6.75	7.63	8.38	7.61	8.13	8.38	8.25	5.50	8.38	8.25	6.50	7.61
6	5.38	6.63	5.25	8.13	8.25	7.23	5.00	8.00	7.23	9.00	8.50	8.13
7	8.88	6.75	8.13	7.50	7.88	7.50	7.99	8.13	7.63	8.25	8.25	9.00
8	7.50	7.95	7.50	8.25	7.00	7.25	7.75	8.88	8.38	8.63	8.38	7.95
9	8.38	8.00	8.48	8.63	9.00	8.38	8.50	7.63	8.63	8.63	9.00	8.50
10	6.50	6.00	5.88	7.63	6.13	7.38	6.38	6.63	5.13	6.63	7.13	8.00
11	7.38	7.88	8.00	8.88	8.13	8.13	9.00	9.00	8.63	9.00	9.00	9.00
12	5.75	6.63	6.75	6.75	7.75	6.88	8.13	7.75	5.75	6.75	7.63	7.50
13	5.25	5.50	5.88	8.25	5.63	9.00	8.25	9.00	9.00	9.00	9.00	9.00
14	6.25	7.88	8.00	7.38	8.38	7.76	7.63	7.50	8.88	7.76	6.88	8.88

Table 10

Group 2: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t5	t5	t6	t7	t8	t9	t10	t11	t12
Average score	7.04	7.22	7.52	8.04	7.74	7.92	7.84	7.64	7.87	8.23	8.06	8.45
Range	1.36	1.92	1.31	1.58	1.79	0.42	1.08	1.69	1.38	1.08	1.29	0.33

Table 11

Group 3: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
(+) 1 St. Dev.	8.09	8.73	9.03	8.75	8.83	8.38	8.51	9.02	8.71	8.80	9.00
Average Satisfaction	7.61	8.19	8.63	8.35	8.35	8.11	7.90	8.70	8.21	8.54	8.81
(-) 1 St. Dev.	7.13	7.66	8.22	7.95	7.87	7.85	7.29	8.38	7.72	8.27	8.62
St. Dev.	0.48	0.53	0.40	0.40	0.48	0.26	0.61	0.32	0.49	0.27	0.19

St. Dev. = Standard Deviation

Table12

Group 3: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
Average of Time	8.20	8.11	8.88	7.90	7.90	8.30	8.90	8.71	8.60	8.70	8.90
Average of Leadership	8.10	8.78	8.75	8.80	8.80	8.60	8.50	9.00	8.90	8.80	9.00
Average of Comfort	7.00	7.00	7.75	7.60	7.40	7.80	7.20	8.00	7.40	8.00	8.40
Average of Trust	7.10	8.33	8.38	8.60	8.60	7.90	7.30	8.71	8.00	8.60	8.90
Average of Respect	8.10	8.56	9.00	8.50	8.60	8.20	8.30	9.00	7.70	8.80	8.90
Average of Honesty	7.70	8.44	8.88	8.60	8.70	8.20	7.70	8.71	8.50	8.40	8.70
Average of Sharing	7.40	8.11	8.75	8.30	8.30	8.00	7.80	8.57	8.40	8.40	8.80
Average of Cohesion	7.30	8.22	8.63	8.50	8.50	7.90	7.50	8.86	8.20	8.60	8.90

Table 13

Group 3: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
Leadership	0.90	0.98	0.97	0.98	0.98	0.96	0.94	1.00	0.99	0.98	1.00
Respect	0.90	0.95	1.00	0.94	0.96	0.91	0.92	1.00	0.86	0.98	0.99
Time	0.91	0.90	0.99	0.88	0.88	0.92	0.99	0.97	0.96	0.97	0.99
Honesty	0.86	0.94	0.99	0.96	0.97	0.91	0.86	0.97	0.94	0.93	0.97
Cohesion	0.81	0.91	0.96	0.94	0.94	0.88	0.83	0.98	0.91	0.96	0.99
Sharing	0.82	0.90	0.97	0.92	0.92	0.89	0.87	0.95	0.93	0.93	0.98
Trust	0.79	0.93	0.93	0.96	0.96	0.88	0.81	0.97	0.89	0.96	0.99
Comfort	0.78	0.78	0.86	0.84	0.82	0.87	0.80	0.89	0.82	0.89	0.93

Table 14

Group 3: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
1	8.63	8.25	8.88	7.75	7.50	8.25	7.63	8.21	7.75	8.75	8.75
2	8.63	8.88	9.00	9.00	8.88	8.25	7.38	8.40	7.13	7.88	9.00
3	7.25	8.25	8.50	7.75	8.25	7.88	7.88	8.38	8.00	7.88	8.75
4	1.25	6.75	8.88	8.50	7.13	9.00	9.00	8.38	9.00	9.00	9.00
5	8.63	8.50	8.88	8.75	8.63	8.38	8.50	9.00	8.63	8.75	9.00
6	7.63	6.75	7.88	8.38	7.75	8.25	7.13	8.63	7.88	8.75	7.88
7	7.88	8.48	8.13	8.38	8.75	8.38	7.88	9.00	9.00	8.38	9.00
8	8.63	9.00	8.03	7.38	8.88	5.00	7.50	8.03	8.63	8.38	8.88
9	9.00	8.75	8.88	8.88	8.88	8.75	8.63	8.50	7.75	8.63	8.88
10	8.63	8.63	8.68	8.75	8.88	9.00	7.50	9.00	8.38	9.00	9.00

Table 15

Group 3: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
Average score	7.61	8.19	8.63	8.35	8.35	8.11	7.90	8.70	8.21	8.54	8.81
Range	1.20	1.78	1.25	1.20	1.40	0.80	1.70	1.00	1.50	0.80	0.60

Table16

Group 4: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9
(+) 1 St. Dev.	8.13	8.64	7.42	7.63	7.97	8.12	7.83	8.26	7.78
Average Satisfaction	7.14	7.62	6.67	7.27	7.33	7.46	7.50	7.59	7.50
(-) 1 St. Dev.	6.16	6.59	5.93	6.90	6.69	6.81	7.17	6.92	7.22
St. Dev.	0.98	1.02	0.7	0.36	0.64	0.66	0.33	0.67	0.28

St. Dev. = Standard Deviation

Table17

Group 4: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9
Average of Time	7.43	6.86	7.08	7.14	6.50	6.69	6.92	7.07	7.69
Average of Leadership	8.07	7.64	7.08	7.07	7.21	7.23	7.69	7.43	7.62
Average of Comfort	5.15	5.57	5.46	6.64	6.36	6.38	7.54	6.21	7.23
Average of Trust	6.57	7.64	5.85	7.36	7.57	7.62	7.69	8.00	7.15
Average of Respect	8.21	8.71	7.15	7.79	8.07	8.31	7.92	8.00	8.00
Average of Honesty	7.71	8.57	7.62	7.64	8.07	8.00	7.69	7.71	7.54
Average of Sharing	7.00	8.29	6.92	7.07	7.50	7.85	7.15	8.21	7.54
Average of Cohesion	7.00	7.64	6.23	7.43	7.36	7.62	7.38	8.07	7.23

Table 18

Group 4: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9
Comfort	0.91	0.97	0.79	0.87	0.90	0.92	0.88	0.89	0.89
Trust	0.86	0.95	0.85	0.85	0.90	0.89	0.85	0.86	0.84
Sharing	0.78	0.92	0.77	0.79	0.83	0.87	0.79	0.91	0.84
Cohesion	0.90	0.85	0.79	0.79	0.80	0.80	0.85	0.83	0.85
Respect	0.78	0.85	0.69	0.83	0.82	0.85	0.82	0.90	0.80
Time	0.73	0.85	0.65	0.82	0.84	0.85	0.85	0.89	0.79
Leadership	0.83	0.76	0.79	0.79	0.72	0.74	0.77	0.79	0.85
Honesty	0.57	0.62	0.61	0.74	0.71	0.71	0.84	0.69	0.80

Table 19

Group 4: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9
1	7.63	7.25	5.50	5.50	8.50	6.50	7.75	8.13	7.63
2	8.63	8.75	8.50	7.13	8.75	8.00	8.08	7.00	7.88
3	7.63	7.13	5.88	7.88	6.88	7.75	7.75	7.13	7.25
4	7.00	7.50	7.25	8.75	7.63	8.13	8.38	5.88	8.13
5	6.88	6.25	6.75	6.38	7.25	6.38	8.13	7.25	7.88
6	5.25	8.63	5.88	6.25	5.38	7.38	7.63	7.88	4.75
7	7.63	8.00	7.88	8.13	7.13	8.38	8.00	7.50	8.63
8	8.63	9.00	8.92	9.00	9.00	8.88	9.00	8.88	9.00
9	7.88	7.75	7.75	8.38	8.25	8.13	8.88	8.13	8.88
10	7.57	7.50	7.13	6.75	7.00	8.13	8.38	8.63	7.38
11	7.38	5.75	5.50	5.63	6.75	5.63	5.63	6.38	6.38
12	5.13	8.50	6.25	6.00	5.88	5.50	6.38	7.13	5.88
13	7.75	8.13	6.38	8.75	7.50	8.25	5.75	9.00	7.88
14	5.38	6.50	6.13	7.25	6.75	6.56	5.88	7.38	7.25

Table 20

Group 4: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9
Average score	7.14	7.62	6.67	7.27	7.33	7.46	7.50	7.59	7.50
Range	3.06	3.14	2.15	1.14	1.71	1.92	1.00	2.00	0.85

Table 21

Group 5: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
(+) 1 St. Dev.	8.29	8.61	8.45	8.26	8.07	8.18	8.10	8.51	8.92	8.79
Average Satisfaction	7.41	8.14	8.05	7.72	7.85	7.79	7.65	8.04	8.73	8.50
(-) 1 St. Dev.	6.53	7.67	7.66	7.18	7.63	7.40	7.20	7.57	8.53	8.21
St. Dev.	0.9	0.47	0.4	0.54	0.22	0.39	0.45	0.47	0.2	0.29

St. Dev. = Standard Deviation

Table 22

Group 5: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
Average of Time	7.81	7.94	7.81	7.75	7.69	7.25	7.07	8.06	8.87	8.44
Average of Leadership	8.25	8.63	8.19	8.56	7.81	8.19	8.00	7.94	8.73	8.81
Average of Comfort	5.63	7.25	7.38	6.75	7.44	7.69	7.53	7.13	8.33	7.88
Average of Trust	7.00	8.13	8.25	7.63	7.94	8.13	8.00	8.38	8.87	8.56
Average of Respect	8.25	8.75	8.69	8.19	8.19	8.25	8.27	8.75	9.00	8.81
Average of Honesty	8.00	8.19	8.13	7.63	7.94	7.38	7.67	8.19	8.67	8.50
Average of Sharing	7.13	7.88	7.75	7.38	7.88	7.50	7.00	7.81	8.67	8.56
Average of Cohesion	7.19	8.38	8.25	7.88	7.94	7.94	7.67	8.06	8.67	8.44

Table 23

Group 5: Area Graph -Proportional Contribution of Dimension Per Time of Measurement and Sorted by Ascending Standard Deviation of Each Dimension

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
Comfort	0.92	0.97	0.97	0.91	0.91	0.92	0.92	0.97	1.00	0.98
Sharing	0.92	0.96	0.91	0.95	0.87	0.91	0.89	0.88	0.97	0.98
Time	0.78	0.90	0.92	0.85	0.88	0.90	0.89	0.93	0.99	0.95
Trust	0.80	0.93	0.92	0.88	0.88	0.88	0.85	0.90	0.96	0.94
Cohesion	0.89	0.91	0.90	0.85	0.88	0.82	0.85	0.91	0.96	0.94
Honesty	0.87	0.88	0.87	0.86	0.85	0.81	0.79	0.90	0.99	0.94
Leadership	0.79	0.88	0.86	0.82	0.88	0.83	0.78	0.87	0.96	0.95
Respect	0.63	0.81	0.82	0.75	0.83	0.85	0.84	0.79	0.93	0.88

Table 24

Group 5: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
1	8.25	8.75	8.13	8.75	8.75	8.63	8.88	8.75	9.00	8.25
2	8.75	8.75	8.63	8.38	9.00	7.13	8.00	7.25	7.75	9.00
3	8.50	8.25	9.00	8.88	8.75	9.00	8.50	8.88	8.88	9.00
4	8.25	8.25	8.13	8.38	7.88	6.75	8.63	8.75	9.00	8.25
5	5.63	8.75	8.13	8.13	7.50	6.63	8.25	8.88	9.00	9.00
6	7.88	8.50	8.38	6.50	9.00	8.75	7.25	8.13	9.00	8.25
7	5.75	8.25	7.00	8.25	1.00	6.00	1.38	7.63	8.75	9.00
8	7.25	8.88	8.88	7.75	7.75	7.75	8.13	7.63	9.00	8.00
9	7.63	8.50	8.63	7.38	7.75	8.63	8.50	8.38	8.75	9.00
10	7.88	8.00	8.13	6.88	8.63	8.38	8.63	8.75	8.13	8.75
11	6.88	7.88	7.88	6.88	8.25	8.00	6.88	7.63	8.13	8.25
12	7.25	7.13	6.75	8.25	9.00	8.38	8.38	6.63	9.00	9.00
13	6.00	5.75	5.75	6.00	8.00	6.13	6.75	6.00	6.46	7.75
14	7.25	7.38	8.25	7.88	7.13	7.75	8.25	8.38	9.00	9.00
15	7.13	8.38	8.38	7.38	8.75	8.00	8.38	8.75	8.75	7.25
16	8.25	8.88	8.88	7.88	8.50	8.75	8.49	8.25	8.75	8.25

Table 25

Group 5: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
Average score	7.41	8.14	8.05	7.72	7.85	7.79	7.65	8.04	8.73	8.50
Range	2.63	1.50	1.31	1.81	0.75	1.00	1.27	1.63	0.67	0.94

Table 26

Group 6: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9
(+) 1 St. Dev.	8.23	8.11	8.24	8.75	8.45	7.44	8.89	8.56	8.39
Average Satisfaction	7.74	7.21	7.65	8.13	7.94	6.98	8.35	8.16	7.97
(-) 1 St. Dev.	7.25	6.32	7.06	7.50	7.43	6.51	7.81	7.76	7.55
St. Dev.	0.49	0.89	0.6	0.62	0.5	0.5	0.54	0.4	0.42

St. Dev. = Standard Deviation

Table 27

Group 6: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9
Average of Time	6.89	6.80	7.64	7.40	7.09	6.60	7.30	7.50	8.09
Average of Leadership	7.78	6.90	7.91	8.40	8.64	7.70	8.40	8.50	8.45
Average of Comfort	7.11	5.60	6.36	7.00	7.45	6.40	7.80	7.80	7.18
Average of Trust	7.89	7.50	7.45	8.10	8.00	6.60	8.60	8.40	8.09
Average of Respect	8.33	8.70	8.36	8.70	8.55	7.50	9.00	8.60	8.45
Average of Honesty	8.11	7.80	7.82	8.80	7.91	7.20	8.60	8.50	7.73
Average of Sharing	7.89	7.40	8.00	8.30	7.91	6.80	8.60	7.90	7.73
Average of Cohesion	7.89	7.00	7.64	8.30	8.00	7.00	8.50	8.10	8.00

Table 28

Group 6: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9
Comfort	0.93	0.97	0.93	0.97	0.95	0.83	1.00	0.96	0.94
Trust	0.86	0.77	0.88	0.93	0.96	0.86	0.93	0.94	0.94
Leadership	0.90	0.87	0.87	0.98	0.88	0.80	0.96	0.94	0.86
Cohesion	0.88	0.83	0.83	0.90	0.89	0.73	0.96	0.93	0.90
Sharing	0.88	0.82	0.89	0.92	0.88	0.76	0.96	0.88	0.86
Honesty	0.88	0.78	0.85	0.92	0.89	0.78	0.94	0.90	0.89
Time	0.77	0.76	0.85	0.82	0.79	0.73	0.81	0.83	0.90
Respect	0.79	0.62	0.71	0.78	0.83	0.71	0.87	0.87	0.80

Table 29

Group 6: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9
1	7.75	7.25	8.00	8.63	9.00	7.25	8.88	8.75	8.00
2	8.00	7.63	8.13	8.13	8.25	7.00	8.13	7.95	8.38
3	7.38	6.13	7.13	7.50	7.00	5.25	7.38	7.00	6.75
4	6.13	5.88	6.25	8.13	8.63	5.75	9.00	8.63	8.25
5	8.00	8.50	8.38	9.00	6.88	6.63	9.00	8.75	9.00
6	8.63	7.25	8.13	8.13	6.63	7.63	8.25	7.75	7.63
7	7.50	7.38	7.38	7.88	8.13	8.13	7.70	7.38	7.88
8	8.38	8.25	9.00	8.88	8.25	7.25	9.00	8.50	8.25
9	7.50	6.63	6.75	7.13	8.25	7.00	8.25	8.25	7.75
10	7.88	8.16	8.25	8.16	8.25	7.88	7.88	8.50	8.50
11	7.61	7.25	6.75	7.88	8.25	7.61	7.75	8.13	7.25

Table 30

Group 6: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9
Average score	7.74	7.21	7.65	8.13	7.94	6.98	8.35	8.16	7.97
Range	1.44	3.10	2.00	1.80	1.55	1.30	1.70	1.10	1.27

Table 31

Group 7: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8
(+) 1 St. Dev.	7.94	8.02	8.10	8.22	8.25	8.03	8.34	8.58
Average Satisfaction	7.06	7.60	7.50	7.66	7.46	7.71	7.93	8.08
(-) 1 St. Dev.	6.17	7.17	6.90	7.09	6.66	7.40	7.52	7.58
St. Dev.	0.88	0.42	0.60	0.57	0.80	0.31	0.41	0.50

St. Dev. = Standard Deviation

Table 32

Group 7: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8
Average of Time	7.33	7.71	7.28	7.56	7.94	7.59	7.50	7.53
Average of Leadership	7.94	8.29	8.33	8.63	8.71	8.18	8.72	8.50
Average of Comfort	5.89	7.00	7.50	6.88	6.47	7.47	7.72	7.28
Average of Trust	6.83	7.29	7.28	7.25	7.06	7.41	7.83	8.28
Average of Respect	8.44	8.06	8.33	8.19	8.41	8.12	8.33	8.78
Average of Honesty	7.39	7.41	7.67	7.94	7.06	7.94	8.00	8.33
Average of Sharing	6.22	7.35	6.83	7.56	6.88	7.53	7.72	8.06
Average of Cohesion	6.39	7.65	6.78	7.25	7.12	7.47	7.61	7.89

Table 33

Group 7: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8
Leadership	0.88	0.92	0.93	0.96	0.97	0.91	0.97	0.94
Respect	0.94	0.90	0.93	0.91	0.93	0.90	0.93	0.98
Honesty	0.82	0.82	0.85	0.88	0.78	0.88	0.89	0.93
Time	0.81	0.86	0.81	0.84	0.88	0.84	0.83	0.84
Trust	0.76	0.81	0.81	0.81	0.78	0.82	0.87	0.92
Sharing	0.69	0.82	0.76	0.84	0.76	0.84	0.86	0.90
Cohesion	0.71	0.85	0.75	0.81	0.79	0.83	0.85	0.88
Comfort	0.65	0.78	0.83	0.76	0.72	0.83	0.86	0.81

Table 34

Group 7: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8
1	6.75	7.50	8.50	8.63	8.25	8.25	7.75	8.00
2	8.00	7.38	7.25	6.38	7.75	8.25	7.88	7.13
3	6.38	6.00	7.13	7.13	6.68	6.00	7.88	6.25
4	7.00	8.00	7.25	8.00	5.88	7.63	6.25	7.38
5	7.50	8.23	7.63	8.63	7.63	8.75	8.63	8.88
6	6.50	8.13	7.38	7.84	7.63	7.88	8.38	9.00
7	4.88	6.25	5.25	7.63	8.00	8.38	8.63	8.63
8	7.38	8.13	7.63	7.63	7.75	7.38	7.50	8.38
9	8.00	7.75	7.00	7.63	7.38	6.88	8.50	8.38
10	8.25	8.25	8.13	7.75	7.88	7.88	8.38	7.88
11	7.13	6.50	8.00	8.88	6.63	7.88	7.50	8.38
12	6.38	7.00	6.38	5.25	7.50	6.75	6.75	7.50
13	6.25	8.50	7.38	8.63	7.38	8.75	8.25	9.00
14	8.25	7.88	7.38	8.50	7.63	7.50	7.13	7.75
15	6.50	7.63	7.88	7.50	5.63	7.75	8.13	8.13
16	7.00	8.38	8.13	8.13	7.88	8.13	8.50	8.88
17	7.88	8.63	9.00	8.63	8.75	8.88	8.50	8.38
18	7.00	7.25	7.75	5.75	7.25	6.38	8.25	7.75

Table 35

Group 7: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8
Average score	7.06	7.60	7.50	7.66	7.46	7.71	7.93	8.08
Range	2.56	1.29	1.56	1.75	2.24	0.76	1.22	1.50

Table 36

Group 8: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
(+) 1 St. Dev.	8.57	6.86	8.94	8.75	8.33	8.57	8.42	8.69	7.83	8.52	8.69	8.95
Average Satisfaction	7.72	6.04	8.72	8.45	7.36	8.33	8.04	8.23	6.54	8.06	8.25	8.89
(-) 1 St. Dev.	6.88	5.22	8.50	8.15	6.39	8.10	7.67	7.77	5.25	7.59	7.81	8.83
St. Dev.	0.84	0.82	0.2	0.3	0.97	0.24	0.38	0.46	1.29	0.46	0.44	0.06

St. Dev. = Standard Deviation

Table 37

Group 8: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
Average of Time	8.33	6.78	8.44	8.50	8.22	8.00	8.22	8.25	8.67	7.67	8.38	8.89
Average of Leadership	8.33	7.67	8.67	8.63	7.89	8.33	8.11	7.63	8.33	7.33	8.50	8.89
Average of Comfort	6.11	5.44	8.89	8.25	6.11	8.33	7.44	7.50	5.22	7.89	8.38	8.89
Average of Trust	7.78	5.78	9.00	8.13	6.44	8.44	8.33	8.75	5.78	8.67	8.50	9.00
Average of Respect	7.78	5.78	8.89	8.63	8.56	8.78	8.67	8.50	6.56	8.56	8.50	8.89
Average of Honesty	8.78	6.11	8.89	8.88	8.22	8.44	7.78	8.50	6.44	8.44	8.50	8.78
Average of Sharing	7.67	5.67	8.44	8.63	7.00	8.22	7.89	8.63	5.78	7.89	7.25	8.89
Average of Cohesion	7.00	5.11	8.56	8.00	6.44	8.11	7.89	8.13	5.56	8.00	8.00	8.89

Table 38

Group 8: Area Graph -Proportional Contribution of Dimension Per Time of Measurement and Sorted by Ascending Standard Deviation of Each Dimension

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
Time	0.93	0.75	0.94	0.94	0.91	0.89	0.91	0.92	0.96	0.85	0.93	0.99
Leadership	0.93	0.85	0.96	0.96	0.88	0.93	0.90	0.85	0.93	0.81	0.94	0.99
Respect	0.86	0.64	0.99	0.96	0.95	0.98	0.96	0.94	0.73	0.95	0.94	0.99
Honesty	0.98	0.68	0.99	0.99	0.91	0.94	0.86	0.94	0.72	0.94	0.94	0.98
Trust	0.86	0.64	1.00	0.90	0.72	0.94	0.93	0.97	0.64	0.96	0.94	1.00
Sharing	0.85	0.63	0.94	0.96	0.78	0.91	0.88	0.96	0.64	0.88	0.81	0.99
Cohesion	0.78	0.57	0.95	0.89	0.72	0.90	0.88	0.90	0.62	0.89	0.89	0.99
Comfort	0.68	0.60	0.99	0.92	0.68	0.93	0.83	0.83	0.58	0.88	0.93	0.99

Table 39

Group 8: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
1	8.00	7.00	8.88	8.88	8.75	8.88	8.50	8.58	8.63	8.88	9.00	9.00
2	8.00	6.38	9.00	8.38	7.50	8.63	7.75	8.75	7.00	8.25	8.13	9.00
3	7.50	7.13	9.00	7.50	7.88	9.00	8.75	7.00	5.75	8.63	9.00	9.00
4	8.13	6.75	9.00	9.00	8.38	8.75	9.00	9.00	6.13	7.75	8.26	9.00
5	8.88	6.00	8.00	8.50	5.75	6.75	6.25	6.75	7.00	7.38	8.63	8.63
6	6.75	5.75	8.50	8.00	8.13	8.50	9.00	9.00	7.50	8.75	8.88	9.00
7	6.13	5.75	8.63	8.38	7.63	8.38	7.88	8.50	7.00	7.63	7.75	8.38
8	7.25	5.13	9.00	9.00	6.88	8.63	6.75	9.00	4.63	7.75	8.63	9.00
9	8.88	4.50	8.50	7.17	5.38	7.50	8.50	7.88	5.25	7.50	6.00	9.00

Table 40

Group 8: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
Average score	7.72	6.04	8.72	8.45	7.36	8.33	8.04	8.23	6.54	8.06	8.25	8.89
Range	2.67	2.56	0.56	0.88	2.44	0.78	1.22	1.25	3.44	1.33	1.25	0.22

Table 41

Group 9: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
(+) 1 St. Dev.	8.26	8.39	9.03	8.50	8.64	8.80	8.75	8.75	8.38	8.89	8.83	8.78	8.84
Average Satisfaction	7.51	7.73	8.60	8.11	8.32	8.38	8.45	8.50	7.51	8.42	8.25	8.57	8.65
(-) 1 St. Dev.	6.76	7.06	8.17	7.73	8.00	7.95	8.15	8.25	6.64	7.95	7.67	8.35	8.45
St. Dev.	0.75	0.66	0.43	0.38	0.32	0.42	0.30	0.25	0.87	0.47	0.58	0.22	0.19

St. Dev. = Standard Deviation

Table 42

Group 9: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average of Time	8.09	8.10	7.70	7.67	8.00	7.50	8.27	8.64	8.10	8.67	8.33	8.36	8.50
Average of Leadership	7.55	7.80	8.90	8.83	8.18	8.25	8.00	8.64	8.40	8.60	7.00	8.45	8.67
Average of Comfort	6.55	6.90	8.50	7.92	8.36	8.17	8.09	7.91	6.30	7.30	7.83	8.18	8.25
Average of Trust	6.55	7.30	8.60	7.83	8.00	8.33	8.55	8.55	7.50	8.40	8.33	8.64	8.83
Average of Respect	8.09	8.70	8.70	8.42	8.91	8.83	8.82	8.64	8.60	8.60	8.58	8.64	8.83
Average of Honesty	8.45	8.40	9.00	8.25	8.64	8.67	8.64	8.55	7.50	8.70	8.75	8.82	8.67
Average of Sharing	7.91	7.70	9.00	8.17	8.36	8.67	8.73	8.45	6.30	8.70	8.50	8.73	8.67
Average of Cohesion	6.91	6.90	8.40	7.83	8.09	8.58	8.55	8.64	7.40	8.40	8.67	8.73	8.75

Table 43

Group 9: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Respect	0.90	0.97	0.97	0.94	0.99	0.98	0.98	0.96	0.96	0.96	0.95	0.96	0.98
Honesty	0.94	0.93	1.00	0.92	0.96	0.96	0.96	0.95	0.83	0.97	0.97	0.98	0.96
Sharing	0.88	0.86	1.00	0.91	0.93	0.96	0.97	0.94	0.70	0.97	0.94	0.97	0.96
Leadership	0.84	0.87	0.99	0.98	0.91	0.92	0.89	0.96	0.93	0.96	0.78	0.94	0.96
Time	0.90	0.90	0.86	0.85	0.89	0.83	0.92	0.96	0.90	0.96	0.93	0.93	0.94
Cohesion	0.77	0.77	0.93	0.87	0.90	0.95	0.95	0.96	0.82	0.93	0.96	0.97	0.97
Trust	0.73	0.81	0.96	0.87	0.89	0.93	0.95	0.95	0.83	0.93	0.93	0.96	0.98
Comfort	0.73	0.77	0.94	0.88	0.93	0.91	0.90	0.88	0.70	0.81	0.87	0.91	0.92

Table 44

Group 9: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
1	8.63	8.68	8.88	8.63	8.68	8.50	8.50	8.75	8.38	8.88	8.71	8.68	9.00
2	5.75	6.75	7.50	6.75	7.13	7.50	7.75	8.00	7.13	8.88	7.29	8.25	8.50
3	8.38	8.63	9.00	9.00	9.00	9.00	9.00	9.00	8.25	9.00	9.00	9.00	9.00
4	7.38	6.25	8.25	7.63	8.13	7.50	7.88	7.88	7.81	8.13	8.13	8.00	8.63
5	7.75	7.50	8.50	7.25	7.88	8.88	8.88	8.88	7.38	8.28	9.00	9.00	8.50
6	7.63	7.75	7.87	7.13	7.38	8.13	8.00	8.00	7.63	7.88	7.86	8.13	9.00
7	8.50	8.00	8.50	8.50	8.50	8.88	8.44	9.00	7.50	8.44	8.43	8.63	8.50
8	7.13	7.25	8.07	8.13	8.63	8.38	8.38	8.25	8.07	8.25	8.00	8.25	8.13
9	8.00	8.75	8.88	8.88	9.00	8.13	9.00	8.88	7.75	8.14	9.00	9.00	8.75
10	8.13	8.88	9.00	8.63	8.88	9.00	8.38	8.88	6.88	7.63	8.38	9.00	8.75
11	6.38	8.35	8.75	8.38	8.88	8.50	8.63	8.35	7.00	8.88	8.71	8.88	8.88
12	7.50	7.50	8.75	8.50	8.13	8.13	8.63	8.00	7.25	8.50	8.29	8.13	8.13

Table 45

Group 9: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average score	7.51	7.73	8.60	8.11	8.32	8.38	8.45	8.50	7.51	8.42	8.25	8.57	8.65
Range	1.91	1.80	1.30	1.17	0.91	1.33	0.82	0.73	2.30	1.40	1.75	0.64	0.58

Table 46

Group 10: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
(+) 1 St. Dev.	7.61	7.71	7.38	8.51	7.25	6.87	7.66	6.67	8.29	7.59
Average Satisfaction	7.23	6.86	6.85	8.11	6.59	6.51	7.48	6.47	8.01	7.33
(-) 1 St. Dev.	6.85	6.01	6.33	7.70	5.94	6.15	7.30	6.26	7.73	7.06
St. Dev.	0.41	0.49	0.48	0.12	0.49	0.22	0.17	0.16	0.25	0.26

St. Dev. = Standard Deviation

Table 47

Group 10: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
Average of Time	7.27	7.71	6.50	8.31	7.31	6.83	7.47	6.53	7.83	7.92
Average of Leadership	6.50	7.57	7.44	8.31	7.38	6.89	7.73	6.58	8.25	7.31
Average of Comfort	6.89	5.29	6.06	7.19	5.50	6.17	7.33	6.21	7.75	7.00
Average of Trust	7.22	6.14	6.72	7.94	6.13	5.89	7.27	6.21	7.67	7.23
Average of Respect	7.44	7.43	7.39	8.25	6.50	6.44	7.60	6.84	7.92	7.31
Average of Honesty	7.44	7.43	7.33	8.19	7.13	6.72	7.53	6.53	8.17	7.31
Average of Sharing	7.33	6.86	6.33	8.19	6.63	6.78	7.27	6.47	8.50	7.23
Average of Cohesion	7.72	6.43	7.06	8.50	6.19	6.33	7.67	6.37	8.00	7.31

Table 48

Group 10: Area Graph-Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
Leadership	0.72	0.84	0.83	0.92	0.82	0.77	0.86	0.73	0.92	0.81
Honesty	0.83	0.83	0.81	0.91	0.79	0.75	0.84	0.73	0.91	0.81
Time	0.81	0.86	0.72	0.92	0.81	0.76	0.83	0.73	0.87	0.88
Respect	0.83	0.83	0.82	0.92	0.72	0.72	0.84	0.76	0.88	0.81
Sharing	0.81	0.76	0.70	0.91	0.74	0.75	0.81	0.72	0.94	0.80
Cohesion	0.86	0.71	0.78	0.94	0.69	0.70	0.85	0.71	0.89	0.81
Trust	0.80	0.68	0.75	0.88	0.68	0.65	0.81	0.69	0.85	0.80
Comfort	0.77	0.59	0.67	0.80	0.61	0.69	0.81	0.69	0.86	0.78

Table 49

Group 10: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
1	7.43	7.13	6.50	7.88	4.50	5.14	7.75	6.00	9.00	6.81
2	7.25	7.88	7.88	8.13	7.38	6.00	8.13	7.88	7.67	8.50
3	8.00	7.88	6.75	8.63	7.81	6.14	8.00	7.88	8.25	8.75
4	6.00	6.31	6.00	6.31	7.88	6.00	6.31	6.00	6.31	6.00
5	7.57	5.75	7.63	8.25	6.38	6.57	7.22	7.38	8.25	7.22
6	1.00	7.42	4.88	8.50	8.75	9.00	7.63	9.00	9.00	9.00
7	8.14	5.50	5.63	8.63	3.00	3.38	5.13	5.13	7.13	9.00
8	7.29	7.88	6.50	8.38	3.38	5.75	5.86	5.75	5.86	2.00
9	7.88	7.46	6.75	8.13	6.25	8.25	6.88	7.00	8.00	8.00
10	8.25	5.86	6.75	5.86	8.50	9.00	9.00	8.63	6.50	5.86
11	8.25	7.56	7.50	7.75	7.13	8.25	6.75	6.88	7.56	8.00
12	6.00	7.64	6.00	8.75	7.64	7.75	8.25	7.75	7.64	9.00
13	8.63	8.69	8.63	8.63	8.88	8.63	8.25	8.63	9.00	9.00
14	6.38	5.51	7.13	5.13	4.63	4.38	7.00	1.00	8.00	6.00
15	6.66	6.66	7.75	6.66	7.88	6.00	6.66	5.00	6.66	6.66
16	9.00	7.99	8.88	9.00	9.00	9.00	8.00	8.00	8.00	3.00
17	7.86	7.33	7.33	8.50	6.00	7.00	6.63	8.00	7.33	7.33
18	8.63	6.50	6.00	9.00	6.00	1.00	8.88	1.00	9.00	9.00
19	6.86	6.00	6.25	6.50	6.23	6.23	6.00	6.00	6.00	6.23

Table 50

<u>Group 10: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation</u>

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
Average score	7.23	6.86	6.85	8.11	6.59	6.51	7.48	6.47	8.01	7.33
Range	1.22	2.43	1.39	1.31	1.88	1.00	0.47	0.63	0.83	0.92

Table 51

Group 11: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
(+) 1 St. Dev.	8.06	8.30	8.28	8.23	8.42	8.50	8.70	8.45	7.99	8.67	8.73	8.60	8.60
Average Satisfaction	7.20	7.62	7.76	7.86	7.93	7.84	8.16	7.57	7.61	8.08	8.04	8.04	8.21
(-) 1 St. Dev.	6.34	6.94	7.23	7.49	7.45	7.19	7.62	6.68	7.22	7.49	7.36	7.49	7.83
St. Dev.	0.86	0.68	0.53	0.37	0.49	0.65	0.54	0.88	0.38	0.59	0.68	0.55	0.39

St. Dev. = Standard Deviation

Table 52

Group 11: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average of Time	7.53	6.47	7.33	7.67	7.41	7.69	7.56	7.71	7.58	7.94	7.17	8.00	8.18
Average of Leadership	7.78	7.76	7.67	8.00	8.17	8.00	8.17	8.00	7.58	8.33	8.06	8.20	8.29
Average of Comfort	5.44	6.82	6.83	7.17	7.06	6.41	7.17	5.41	6.79	6.67	6.78	6.73	7.29
Average of Trust	6.83	7.94	8.06	7.83	8.11	8.18	8.50	7.76	7.63	8.22	8.39	8.40	8.35
Average of Respect	8.28	8.59	8.56	8.39	8.61	8.53	8.61	7.94	7.58	8.50	8.56	8.47	8.53
Average of Honesty	7.72	8.06	8.17	8.22	8.17	8.35	8.72	8.00	8.05	8.28	8.50	8.27	8.35
Average of Sharing	6.89	7.76	7.72	7.78	8.06	7.65	8.44	8.06	8.00	8.33	8.44	8.00	8.29
Average of Cohesion	7.11	7.53	7.72	7.83	7.89	7.94	8.11	7.65	7.63	8.33	8.44	8.27	8.41

Table 53

Group 11: Area Graph -Proportional Contribution of Dimension Per Time of Measurement and Sorted by Ascending Standard Deviation of Each Dimension

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Respect	0.92	0.95	0.95	0.93	0.96	0.95	0.96	0.88	0.84	0.94	0.95	0.94	0.95
Honesty	0.86	0.90	0.91	0.91	0.91	0.93	0.97	0.89	0.89	0.92	0.94	0.92	0.93
Trust	0.76	0.88	0.90	0.87	0.90	0.91	0.94	0.86	0.85	0.91	0.93	0.93	0.93
Leadership	0.86	0.86	0.85	0.89	0.91	0.89	0.91	0.89	0.84	0.93	0.90	0.91	0.92
Sharing	0.77	0.86	0.86	0.86	0.90	0.85	0.94	0.90	0.89	0.93	0.94	0.89	0.92
Cohesion	0.79	0.84	0.86	0.87	0.88	0.88	0.90	0.85	0.85	0.93	0.94	0.92	0.93
Time	0.84	0.72	0.81	0.85	0.82	0.85	0.84	0.86	0.84	0.88	0.80	0.89	0.91
Comfort	0.60	0.76	0.76	0.80	0.78	0.71	0.80	0.60	0.75	0.74	0.75	0.75	0.81

Table 54

Group 11: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
1	7.25	7.63	7.25	6.00	7.75	8.25	8.25	7.50	6.00	7.13	8.50	7.88	8.00
2	8.50	8.88	8.25	8.88	8.75	7.38	9.00	8.38	9.00	9.00	8.13	8.59	9.00
3	7.38	7.50	8.88	8.50	8.63	8.88	8.88	7.13	7.88	9.00	8.63	8.32	8.63
4	7.50	8.25	8.50	7.88	6.50	8.63	8.13	7.88	8.38	8.25	8.25	8.75	8.63
5	6.38	7.25	6.75	7.38	7.63	7.75	8.00	7.13	7.75	7.63	7.63	7.50	7.88
6	8.63	8.25	8.25	9.00	8.88	8.75	9.00	9.00	8.88	8.75	9.00	9.00	9.00
7	6.88	7.88	7.38	8.50	7.29	7.63	7.13	7.88	7.25	8.63	8.00	9.00	9.00
8	5.88	5.75	5.88	6.00	5.88	6.00	6.00	6.38	6.00	6.00	6.00	6.00	6.00
9	7.13	8.38	7.88	8.50	8.50	8.25	8.75	8.13	8.63	8.63	8.38	8.63	9.00
10	8.50	9.00	8.88	8.88	8.25	8.00	9.00	7.38	6.50	7.13	8.63	8.63	8.23
11	5.75	6.63	7.88	7.25	7.25	7.44	8.13	7.88	8.38	8.38	6.88	7.50	7.38
12	7.75	7.88	8.50	7.88	8.88	7.88	8.13	8.63	8.50	8.50	8.75	8.50	8.63
13	7.75	8.00	7.50	8.13	8.38	7.63	9.00	8.38	8.13	8.50	8.75	8.50	8.38
14	8.25	7.63	7.25	7.13	7.38	7.75	7.75	7.00	7.75	7.63	8.13	7.75	7.63
15	6.50	5.00	6.88	8.00	8.75	8.25	8.75	6.63	6.00	8.13	7.88	7.88	8.25
16	5.13	7.23	7.38	7.00	7.13	6.13	7.13	7.38	7.38	7.88	8.63	7.75	7.88
17	6.57	7.00	8.00	8.25	8.38	7.50	7.63	7.25	7.13	7.50	7.63	7.38	8.63
18	7.75	8.63	8.38	8.38	8.63	8.50	8.25	6.63	6.13	8.75	7.00	7.90	7.75

Table 55

Group 11: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average score	7.20	7.62	7.76	7.86	7.93	7.84	8.16	7.57	7.61	8.08	8.04	8.04	8.21
Range	2.83	2.12	1.72	1.22	1.56	2.12	1.56	2.65	1.26	1.83	1.78	1.73	1.24

Table 56

Group 12: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
(+) 1 St. Dev.	8.08	8.11	9.02	8.97	8.90	8.90	8.91	9.08	8.60	8.96	8.84	8.96	8.98
Average Satisfaction	7.55	7.56	8.53	8.76	8.58	8.53	8.55	8.66	8.31	8.83	8.76	8.88	8.84
(-) 1 St. Dev.	7.03	7.01	8.03	8.54	8.26	8.16	8.20	8.24	8.02	8.69	8.68	8.79	8.70
St. Dev.	0.53	0.55	0.50	0.22	0.32	0.37	0.35	0.42	0.29	0.13	0.08	0.08	0.14

St. Dev. = Standard Deviation

Table 57

Group 12: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average of Time	7.86	7.64	7.79	8.57	8.14	7.85	8.07	8.07	8.54	8.85	8.83	8.71	8.86
Average of Leadership	8.00	8.43	8.71	8.86	8.93	8.69	8.86	8.93	8.62	8.92	8.75	8.93	8.93
Average of Comfort	6.79	7.36	7.71	8.36	8.21	8.08	8.00	7.93	7.85	8.54	8.67	8.79	8.57
Average of Trust	7.07	7.07	8.64	8.79	8.36	8.62	8.64	8.93	8.23	8.92	8.75	8.93	8.71
Average of Respect	8.00	7.86	9.00	9.00	9.00	8.92	9.00	9.00	8.54	8.92	8.92	8.93	9.00
Average of Honesty	8.21	8.14	8.93	9.00	8.71	8.62	8.71	8.79	8.31	8.92	8.75	8.93	8.86
Average of Sharing	7.29	6.93	8.79	8.71	8.64	8.69	8.57	8.93	8.46	8.77	8.67	8.93	8.86
Average of Cohesion	7.21	7.07	8.64	8.79	8.64	8.77	8.57	8.71	7.92	8.77	8.75	8.86	8.93

Table 58

<u>Group 12: Area Graph -Proportional Contribution of Dimension Per Time of Measurement</u>

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Respect	0.89	0.87	1.00	1.00	1.00	0.99	1.00	1.00	0.95	0.99	0.99	0.99	1.00
Leadership	0.89	0.94	0.97	0.98	0.99	0.97	0.98	0.99	0.96	0.99	0.97	0.99	0.99
Honesty	0.91	0.90	0.99	1.00	0.97	0.96	0.97	0.98	0.92	0.99	0.97	0.99	0.98
Sharing	0.81	0.77	0.98	0.97	0.96	0.97	0.95	0.99	0.94	0.97	0.96	0.99	0.98
Trust	0.79	0.79	0.96	0.98	0.93	0.96	0.96	0.99	0.91	0.99	0.97	0.99	0.97
Cohesion	0.80	0.79	0.96	0.98	0.96	0.97	0.95	0.97	0.88	0.97	0.97	0.98	0.99
Time	0.87	0.85	0.87	0.95	0.90	0.87	0.90	0.90	0.95	0.98	0.98	0.97	0.98
Comfort	0.75	0.82	0.86	0.93	0.91	0.90	0.89	0.88	0.87	0.95	0.96	0.98	0.95

Table 59

Group 12: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
1	8.25	5.75	8.88	8.75	8.88	8.88	8.88	8.88	9.00	8.88	8.50	9.00	8.25
2	8.25	7.63	9.00	8.63	8.38	8.75	8.63	8.63	8.25	8.88	8.53	8.88	8.50
3	7.25	6.38	8.63	8.88	7.63	7.63	8.00	8.63	7.50	8.63	8.38	8.38	8.75
4	9.00	8.50	9.00	8.88	9.00	8.63	9.00	8.75	8.88	8.88	8.50	9.00	9.00
5	7.88	8.13	8.75	8.88	9.00	9.00	8.50	8.38	8.63	9.00	9.00	9.00	9.00
6	7.57	7.00	7.88	9.00	9.00	9.00	8.50	8.63	8.63	9.00	9.00	9.00	9.00
7	8.88	8.75	9.00	9.00	9.00	8.97	9.00	9.00	9.00	9.00	8.97	9.00	9.00
8	8.13	8.75	8.38	8.63	8.63	8.63	8.63	8.75	8.65	8.63	8.88	8.88	8.88
9	7.88	6.25	8.13	8.00	8.50	7.88	8.88	8.50	9.00	8.33	9.00	9.00	9.00
10	8.50	8.00	8.38	8.75	9.00	8.50	8.63	9.00	8.88	9.00	9.00	9.00	9.00
11	7.25	7.63	8.75	9.00	9.00	9.00	9.00	9.00	6.00	8.13	9.00	9.00	9.00
12	1.75	7.50	7.88	8.75	7.50	8.25	8.13	7.63	7.50	8.75	8.63	8.63	8.63
13	8.50	8.50	8.88	8.63	8.75	8.75	8.75	8.88	9.00	9.00	8.75	9.00	9.00
14	6.63	7.13	7.88	8.88	7.88	8.00	7.25	8.63	7.75	9.00	8.50	8.50	8.75

Table 60

Group 12: X-Bar-R Chart and R Chart- Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average score	7.55	7.56	8.53	8.76	8.58	8.53	8.55	8.66	8.31	8.83	8.76	8.88	8.84
Range	1.43	1.50	1.29	0.64	0.86	1.08	1.00	1.07	0.77	0.38	0.25	0.21	0.43

Table 61

Group 13: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
(+) 1 St. Dev.	8.66	8.02	7.63	7.49	7.67	8.32	7.67	7.80	8.03	8.68	8.84	8.40	8.98
Average Satisfaction	6.95	6.59	7.05	6.69	7.33	7.80	7.20	7.50	7.61	8.45	8.31	7.81	8.48
(-) 1 St. Dev.	5.25	5.16	6.46	5.88	7.00	7.27	6.74	7.20	7.19	8.22	7.78	7.22	7.99
St. Dev.	1.71	1.43	0.59	0.81	0.33	0.53	0.46	0.30	0.42	0.23	0.53	0.59	0.49

St. Dev. = Standard Deviation

Table 62

Group 13: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average of Time	8.38	8.29	6.38	7.00	7.50	8.38	7.13	7.38	7.88	8.20	8.17	7.63	8.50
Average of Leadership	8.13	8.00	7.88	8.00	8.00	8.50	7.38	7.63	7.88	8.80	8.17	8.38	9.00
Average of Comfort	3.38	4.57	6.63	7.00	7.17	6.88	6.25	7.25	7.00	8.20	7.17	6.63	7.50
Average of Trust	6.25	6.00	7.13	5.63	7.17	8.00	7.13	7.25	7.88	8.20	8.83	7.75	8.38
Average of Respect	8.38	8.00	7.38	7.25	7.50	7.88	7.88	8.00	8.25	8.60	8.50	8.63	8.88
Average of Honesty	7.63	7.00	7.75	6.75	7.00	7.63	7.13	7.75	7.25	8.60	8.33	7.75	8.88
Average of Sharing	7.50	5.71	6.88	6.13	7.33	7.38	7.25	7.13	7.38	8.40	8.50	7.88	8.13
Average of Cohesion	6.00	5.14	6.38	5.75	7.00	7.75	7.50	7.63	7.38	8.60	8.83	7.88	8.63

Table 63

Group 13: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Leadership	0.90	0.89	0.88	0.89	0.89	0.94	0.82	0.85	0.88	0.98	0.91	0.93	1.00
Respect	0.93	0.89	0.82	0.81	0.83	0.88	0.88	0.89	0.92	0.96	0.94	0.96	0.99
Time	0.93	0.92	0.71	0.78	0.83	0.93	0.79	0.82	0.88	0.91	0.91	0.85	0.94
Honesty	0.85	0.78	0.86	0.75	0.78	0.85	0.79	0.86	0.81	0.96	0.93	0.86	0.99
Trust	0.69	0.67	0.79	0.63	0.80	0.89	0.79	0.81	0.88	0.91	0.98	0.86	0.93
Sharing	0.83	0.63	0.76	0.68	0.81	0.82	0.81	0.79	0.82	0.93	0.94	0.88	0.90
Cohesion	0.67	0.57	0.71	0.64	0.78	0.86	0.83	0.85	0.82	0.96	0.98	0.88	0.96
Comfort	0.38	0.51	0.74	0.78	0.80	0.76	0.69	0.81	0.78	0.91	0.80	0.74	0.83

Table 64

Group 13: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
1	6.00	5.63	5.50	6.00	6.30	5.50	5.00	6.25	6.00	6.30	6.30	8.38	8.75
2	7.63	7.38	8.13	7.63	8.25	8.25	8.50	7.75	7.75	7.93	7.75	7.88	8.25
3	6.63	7.00	6.88	4.50	4.38	6.75	6.13	6.25	5.63	7.25	6.50	6.88	7.13
4	8.13	7.63	8.63	8.50	8.25	8.75	8.75	8.50	8.88	8.54	8.88	8.75	8.88
5	6.63	6.38	4.13	6.63	7.13	8.25	5.13	6.00	8.38	8.13	6.88	7.75	8.00
6	6.88	7.38	8.25	7.00	8.04	7.50	7.63	8.00	7.88	9.00	9.00	9.00	9.00
7	7.88	8.18	7.13	8.13	8.00	8.38	7.50	8.38	7.50	8.88	8.75	8.75	8.88
8	5.88	4.75	7.75	5.13	8.00	9.00	9.00	8.88	8.88	9.00	9.00	5.13	9.00

Table 65

Group 13: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
Average score	6.95	6.59	7.05	6.69	7.33	7.80	7.20	7.50	7.61	8.45	8.31	7.81	8.48
Range	5.00	3.71	1.50	2.38	1.00	1.63	1.63	0.88	1.25	0.60	1.67	2.00	1.50

Table 66

Group 14: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14
(+) 1 St. Dev.	8.18	8.35	8.53	9.01	8.92	8.92	8.85	8.73	9.01	9.11	8.84	8.95	9.20	9.08
Average Satisfaction	7.81	7.81	8.32	8.63	8.50	8.61	8.33	8.31	8.75	8.74	8.75	8.54	8.69	8.85
(-) 1 St. Dev.	7.44	7.26	8.11	8.24	8.08	8.30	7.80	7.88	8.49	8.37	8.66	8.13	8.19	8.61
St. Dev.	0.37	0.54	0.21	0.38	0.42	0.31	0.53	0.42	0.26	0.37	0.09	0.41	0.50	0.24

St. Dev. = Standard Deviation

Table 67

Group 14: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14
Average of Time	7.38	6.89	7.89	8.22	8.11	8.13	7.25	7.56	8.33	8.00	8.88	8.22	7.78	8.67
Average of Leadership	8.25	7.89	8.33	8.78	8.89	8.75	8.25	8.67	8.78	8.78	8.75	8.67	8.89	9.00
Average of Comfort	7.63	7.78	8.22	7.89	7.67	8.13	7.88	7.78	8.33	8.33	8.63	7.67	8.00	8.33
Average of Trust	7.88	7.89	8.56	8.67	8.56	8.63	8.63	8.56	8.89	9.00	8.75	8.89	9.00	9.00
Average of Respect	8.38	8.78	8.33	8.89	8.89	8.75	8.75	8.44	9.00	8.89	8.63	8.67	9.00	8.89
Average of Honesty	8.00	8.00	8.56	9.00	8.67	8.88	8.63	8.67	8.89	9.00	8.88	8.67	8.89	9.00
Average of Sharing	7.50	7.89	8.33	8.89	8.67	8.88	8.50	8.56	8.89	8.89	8.75	8.67	9.00	8.89
Average of Cohesion	7.50	7.33	8.33	8.67	8.56	8.75	8.75	8.22	8.89	9.00	8.75	8.89	9.00	9.00

Table 68

Group 14: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14
Respect	0.93	0.98	0.93	0.99	0.99	0.97	0.97	0.94	1.00	0.99	0.96	0.96	1.00	0.99
Honesty	0.89	0.89	0.95	1.00	0.96	0.99	0.96	0.96	0.99	1.00	0.99	0.96	0.99	1.00
Trust	0.88	0.88	0.95	0.96	0.95	0.96	0.96	0.95	0.99	1.00	0.97	0.99	1.00	1.00
Leadership	0.92	0.88	0.93	0.98	0.99	0.97	0.92	0.96	0.98	0.98	0.97	0.96	0.99	1.00
Sharing	0.83	0.88	0.93	0.99	0.96	0.99	0.94	0.95	0.99	0.99	0.97	0.96	1.00	0.99
Cohesion	0.83	0.81	0.93	0.96	0.95	0.97	0.97	0.91	0.99	1.00	0.97	0.99	1.00	1.00
Comfort	0.85	0.86	0.91	0.88	0.85	0.90	0.88	0.86	0.93	0.93	0.96	0.85	0.89	0.93
Time	0.82	0.77	0.88	0.91	0.90	0.90	0.81	0.84	0.93	0.89	0.99	0.91	0.86	0.96

Table 69

Group 14: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14
1	8.80	8.00	8.25	8.88	9.00	8.75	9.00	8.50	9.00	9.00	9.00	9.00	9.00	9.00
2	8.50	8.63	9.00	9.00	9.00	9.00	9.00	8.75	9.00	9.00	9.00	8.63	9.00	9.00
3	6.38	7.50	7.25	7.75	8.38	8.22	7.63	8.63	8.50	8.88	9.00	9.00	9.00	9.00
4	7.50	7.50	7.88	8.25	7.63	8.13	7.63	7.63	8.63	8.00	7.82	7.75	7.13	8.00
5	7.88	8.63	9.00	9.00	8.25	8.75	9.00	8.88	8.88	9.00	9.00	8.63	9.00	9.00
6	7.75	6.38	9.00	9.00	9.00	8.88	8.49	7.38	9.00	8.63	8.75	8.63	9.00	9.00
7	8.63	8.38	8.75	9.00	9.00	9.00	9.00	8.00	9.00	9.00	9.00	9.00	9.00	9.00
8	8.00	7.88	7.50	8.25	8.00	8.13	7.75	8.63	7.75	8.75	8.38	8.25	9.00	9.00
9	7.88	7.38	8.25	8.50	8.25	8.25	7.63	8.38	9.00	8.38	7.88	8.00	8.13	8.63

Table 70

Group 14: X-Bar-R Chart and R Chart- Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14
Average score	7.81	7.81	8.32	8.63	8.50	8.61	8.33	8.31	8.75	8.74	8.75	8.54	8.69	8.85
Range	1.00	1.89	0.67	1.11	1.22	0.75	1.50	1.11	0.67	1.00	0.25	1.22	1.22	0.67

Table 71

Group 15: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
(+) 1 St. Dev.	7.77	7.74	7.68	7.93	7.85	7.46	7.65	8.07	8.23	7.88	7.78	7.80
Average Satisfaction	6.92	7.41	7.22	7.63	7.49	7.15	6.99	7.67	7.90	7.76	7.43	7.41
(-) 1 St. Dev.	6.07	7.09	6.76	7.32	7.13	6.84	6.34	7.26	7.57	7.64	7.08	7.01
St. Dev.	0.85	0.33	0.46	0.31	0.36	0.31	0.66	0.41	0.33	0.12	0.35	0.40

St. Dev. = Standard Deviation

Table 72

Group 15: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
Average of Time	7.00	6.88	7.63	7.56	7.67	6.63	7.88	7.53	7.73	7.73	7.19	7.67
Average of Leadership	7.53	7.63	7.69	7.44	7.60	7.00	7.31	7.67	7.73	7.60	7.75	8.07
Average of Comfort	5.33	7.06	6.75	7.31	7.13	7.13	6.00	7.07	7.67	7.87	7.31	7.40
Average of Trust	6.67	7.44	7.13	7.69	7.67	7.31	6.13	7.80	7.80	7.67	7.88	7.53
Average of Respect	7.87	7.75	7.88	8.25	8.13	7.63	7.31	8.47	8.40	7.87	7.63	7.47
Average of Honesty	7.80	7.81	7.19	7.88	7.47	7.44	7.50	7.87	8.27	7.87	7.63	7.33
Average of Sharing	6.87	7.44	6.69	7.38	7.00	7.06	7.00	7.53	8.13	7.60	6.81	6.73
Average of Cohesion	6.27	7.31	6.81	7.50	7.27	7.00	6.81	7.40	7.47	7.87	7.25	7.07

Table 73

Group 15: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
Respect	0.87	0.86	0.88	0.92	0.90	0.85	0.81	0.94	0.93	0.87	0.85	0.83
Honesty	0.87	0.87	0.80	0.88	0.83	0.83	0.83	0.87	0.92	0.87	0.85	0.81
Leadership	0.84	0.85	0.85	0.83	0.84	0.78	0.81	0.85	0.86	0.84	0.86	0.90
Time	0.78	0.76	0.85	0.84	0.85	0.74	0.88	0.84	0.86	0.86	0.80	0.85
Trust	0.74	0.83	0.79	0.85	0.85	0.81	0.68	0.87	0.87	0.85	0.88	0.84
Sharing	0.76	0.83	0.74	0.82	0.78	0.78	0.78	0.84	0.90	0.84	0.76	0.75
Cohesion	0.70	0.81	0.76	0.83	0.81	0.78	0.76	0.82	0.83	0.87	0.81	0.79
Comfort	0.59	0.78	0.75	0.81	0.79	0.79	0.67	0.79	0.85	0.87	0.81	0.82

Table 74

Group 15: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
1	5.00	5.88	5.75	6.63	4.00	6.25	4.50	6.02	7.13	6.13	6.75	8.25
2	5.88	5.75	4.25	6.00	6.38	5.88	5.75	7.38	7.88	6.00	6.00	8.00
3	8.63	8.25	8.75	9.00	8.25	8.25	8.25	8.00	8.50	9.00	8.63	6.00
4	7.22	8.63	8.25	8.00	8.00	5.88	7.13	7.13	7.63	8.00	6.50	4.25
5	5.00	7.88	8.13	8.75	8.63	6.13	6.25	7.13	5.75	6.50	6.00	5.00
6	6.13	6.75	5.63	7.00	6.38	5.25	5.50	7.13	7.88	7.88	8.25	9.00
7	8.63	8.63	8.50	6.00	8.53	9.00	9.00	9.00	9.00	9.00	8.13	9.00
8	7.50	8.00	7.00	7.88	8.25	7.50	8.25	9.00	7.88	9.00	7.50	7.98
9	7.25	8.25	8.75	8.00	9.00	8.75	6.63	8.50	8.88	8.75	7.25	8.88
10	7.00	7.25	7.50	8.00	7.88	7.75	5.63	6.38	7.63	6.38	7.00	7.13
11	6.81	5.75	7.13	6.81	6.88	6.88	6.88	7.25	6.75	7.63	6.50	6.50
12	6.88	6.88	7.13	7.50	7.88	6.13	7.38	7.75	8.50	8.25	7.88	8.63
13	7.13	6.50	6.13	7.00	6.63	6.75	7.00	6.88	7.63	7.75	7.75	8.50
14	8.38	8.75	8.63	9.00	8.75	8.63	8.88	8.50	8.88	8.50	8.50	8.00
15	8.13	8.63	6.88	8.00	8.38	8.38	7.50	7.88	8.63	8.15	8.75	8.50
16	5.50	6.88	6.88	8.25	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88
17	6.75	6.88	7.13	7.00	7.13	7.00	7.38	7.13	7.00	7.63	7.50	5.50

Table 75

Group 15: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
Average score	6.92	7.41	7.22	7.63	7.49	7.15	6.99	7.67	7.90	7.76	7.43	7.41
Range	2.53	0.94	1.19	0.94	1.13	1.00	1.88	1.40	0.93	0.27	1.06	1.33

Table 76

Group 16: Line Graph and Standard Deviation Enhanced Line Graph Values

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
(+) 1 St. Dev.	7.15	7.64	7.84	8.26	8.66	8.58	7.80	8.07	8.30	8.37	8.52
Average Satisfaction	5.59	7.17	7.32	7.73	7.80	7.55	7.45	7.53	7.86	8.09	7.92
(-) 1 St. Dev.	4.03	6.71	6.79	7.20	6.94	6.52	7.11	6.99	7.42	7.82	7.33
St. Dev.	1.56	0.47	0.53	0.53	0.86	1.03	0.34	0.54	0.44	0.28	0.60

St. Dev. = Standard Deviation

Table 77

Group 16: Average of Dimensions of Change Across Sessions

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
Average of Time	6.71	6.81	7.20	6.88	7.13	7.53	7.50	7.54	7.63	8.06	7.88
Average of Leadership	7.47	7.56	7.80	8.19	7.20	7.53	7.50	7.54	8.06	8.00	8.13
Average of Comfort	2.73	6.88	6.53	7.13	6.27	5.13	7.38	6.38	6.94	7.69	6.50
Average of Trust	5.00	7.13	7.20	7.69	8.33	7.60	7.38	7.46	7.94	8.19	8.19
Average of Respect	6.73	7.75	8.20	8.44	8.73	8.47	8.19	8.31	8.44	8.63	8.38
Average of Honesty	6.60	7.75	7.60	8.13	8.67	8.00	7.50	7.85	8.13	8.25	8.13
Average of Sharing	4.80	7.00	6.93	7.69	8.00	8.13	7.13	7.69	7.88	8.06	8.25
Average of Cohesion	4.67	6.50	7.07	7.69	8.07	8.00	7.06	7.46	7.88	7.88	7.94

Table 78

Group 16: Area Graph -Proportional Contribution of Dimension Per Time of Measurement

Times of observation	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
Respect	0.75	0.86	0.91	0.94	0.97	0.94	0.91	0.92	0.94	0.96	0.93
Sharing	0.53	0.78	0.77	0.85	0.89	0.90	0.79	0.85	0.88	0.90	0.92
Trust	0.56	0.79	0.80	0.85	0.93	0.84	0.82	0.83	0.88	0.91	0.91
Leadership	0.83	0.84	0.87	0.91	0.80	0.84	0.83	0.84	0.90	0.89	0.90
Honesty	0.73	0.86	0.84	0.90	0.96	0.89	0.83	0.87	0.90	0.92	0.90
Cohesion	0.52	0.72	0.79	0.85	0.90	0.89	0.78	0.83	0.88	0.88	0.88
Time	0.75	0.76	0.80	0.76	0.79	0.84	0.83	0.84	0.85	0.90	0.88
Comfort	0.30	0.76	0.73	0.79	0.70	0.57	0.82	0.71	0.77	0.85	0.72

Table 79

Group 16: Average Satisfaction of Subjects Per Time of Observation

Subject	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
1	4.29	8.25	8.88	8.50	7.13	6.88	8.38	8.38	8.88	9.00	7.63
2	7.63	7.75	8.13	8.63	8.63	8.13	8.25	8.00	8.50	8.88	9.00
3	5.13	6.75	2.00	8.38	6.63	6.50	7.63	6.88	7.75	7.25	7.38
4	6.63	6.88	7.13	7.13	7.75	7.38	5.63	7.33	8.13	8.50	8.13
5	5.13	9.00	6.00	9.00	8.63	9.00	8.88	7.75	8.63	9.00	9.00
6	7.13	8.50	8.25	8.00	8.63	9.00	8.25	8.63	9.00	9.00	8.50
7	4.88	6.00	7.46	5.50	6.63	8.75	8.50	8.25	8.63	8.63	8.88
8	7.91	7.38	7.50	8.50	7.63	7.75	8.38	7.75	8.38	7.50	8.38
9	6.00	6.00	7.75	8.25	7.53	7.13	7.88	7.53	8.38	8.00	8.38
10	5.13	7.63	7.13	6.13	6.00	6.13	6.75	6.13	6.38	7.25	6.75
11	5.50	6.38	7.00	6.88	8.00	6.76	5.50	6.00	7.00	7.75	7.63
12	5.75	5.50	7.00	6.38	7.63	6.25	7.50	6.00	7.13	7.88	6.00
13	7.00	9.00	9.00	8.88	8.88	8.75	6.50	8.50	8.25	8.75	9.00
14	6.25	6.25	8.00	7.25	7.50	7.00	5.13	7.38	7.25	7.75	8.00
15	5.25	5.50	8.00	7.75	9.00	6.63	7.75	6.69	5.63	6.00	5.38
16	1.88	8.00	8.00	8.50	8.38	8.00	8.38	8.25	7.88	8.38	8.75

Table 80

Group 16: X-Bar-R Chart and R Chart - Mean Values and Range Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
Average score	5.59	7.17	7.32	7.73	7.80	7.55	7.45	7.53	7.86	8.09	7.92
Range	4.73	1.25	1.67	1.56	2.47	3.33	1.13	1.92	1.50	0.94	1.88

Table 81

Multiple Groups: Dimensions of Change Across Weeks

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14
Leadership	7.78	7.88	8.05	8.25	8.04	7.96	8.07	8.06	8.25	8.30	8.25	8.48	8.77	9.00
Trust	6.92	7.27	7.69	7.72	7.72	7.75	7.86	8.06	7.85	8.35	8.47	8.47	8.69	9.00
Sharing	7.15	7.34	7.61	7.84	7.74	7.76	7.81	7.99	7.86	8.25	8.26	8.35	8.60	8.89
Cohesion	6.87	7.09	7.53	7.80	7.66	7.80	7.85	7.98	7.79	8.30	8.37	8.43	8.74	9.00
Time	7.62	7.37	7.50	7.71	7.61	7.51	7.64	7.65	8.09	8.17	8.19	8.22	8.39	8.67
Honesty	5.86	6.62	7.39	7.54	7.07	7.25	7.39	7.16	7.21	7.77	7.71	7.84	8.04	8.50
Respect	5.79	6.50	7.27	7.39	7.05	7.17	7.38	7.14	7.22	7.73	7.66	7.77	7.94	8.33
Comfort	5.86	6.52	7.09	7.24	6.87	7.20	7.39	7.13	7.25	7.73	7.65	7.85	8.02	8.33

Table 82

Multiple Groups- Identified By Group Number and Leader: Average Satisfaction Per Time of Observation

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14
Group 14 (Ldr. A)	7.81	7.81	8.32	8.63	8.50	8.61	8.33	8.31	8.75	8.74	8.75	8.54	8.69	8.85
Group 12 ((Ldr. A)	7.55	7.56	8.53	8.76	8.58	8.53	8.55	8.66	8.31	8.83	8.76	8.88	8.84	
Group 9 (Ldr. A)	7.51	7.73	8.60	8.11	8.32	8.38	8.45	8.50	7.51	8.42	8.25	8.57	8.65	
Group 1 (Ldr. A)	7.62	8.17	7.08	6.97	7.39	7.56	8.09	8.16	8.33	8.24	8.42	8.56	8.70	
Group 11 (Ldr. A)	7.20	7.62	7.76	7.86	7.93	7.84	8.16	7.57	7.61	8.08	8.04	8.04	8.21	
Group 13 (Ldr. C)	6.95	6.59	7.05	6.69	7.33	7.80	7.20	7.50	7.61	8.45	8.31	7.81	8.48	
Group 8 (Ldr. A)	7.72	6.04	8.72	8.45	7.36	8.33	8.04	8.23	6.54	8.06	8.25	8.89		
Group 2 (Ldr. A)	7.04	7.22	7.52	8.04	7.74	7.92	7.84	7.64	7.87	8.23	8.06	8.45		
Group 3 (Ldr. B)	7.61	8.19	8.63	8.35	8.35	8.11	7.90	8.70	8.21	8.54	8.81			
Group 15 (Ldr. A)	6.92	7.41	7.22	7.63	7.49	7.15	6.99	7.67	7.90	7.76	7.43	7.41		
Group 16 (Ldr. A)	5.59	7.17	7.32	7.73	7.80	7.55	7.45	7.53	7.86	8.09	7.92			
Group 5 (Ldr. A)	7.41	8.14	8.05	7.72	7.85	7.79	7.65	8.04	8.73	8.50				
Group 10 (Ldr. C)	7.23	6.86	6.85	8.11	6.59	6.51	7.48	6.47	8.01	7.33				
Group 6 (Ldr. B)	7.74	7.21	7.65	8.13	7.94	6.98	8.35	8.16	7.97					
Group 4 (Ldr. A)	7.14	7.62	6.67	7.27	7.33	7.46	7.50	7.59	7.50					
Group 7 (Ldr. B)	7.06	7.60	7.50	7.66	7.46	7.71	7.93	8.08						

Ldr. = Group leader designated as leader A, B, or C.

Table 83

Descriptive Statistics

	Mean	Std. Deviation[a]	Analysis N[a]	Missing N
TIME	7.4730	1.7211	231	9
LEADERSHIP	7.6000	1.7057	231	1
COMFORT	5.6435	2.3357	231	1
TRUST	6.6926	1.9056	231	0
RESPECT	7.8874	1.6246	231	0
HONESTY	7.6277	1.6991	231	0
SHARING	6.8615	1.9995	231	0
COHESION	6.6537	1.9273	231	0

a. For each variable, missing values are replaced with the variable mean.

Table 84

Kruskal-Wallace H: Ranks

	Group	N*	Mean Rank
AVGSAT	1	247	1229.18
	2	156	1161.25
	3	104	1535.18
	4	122	860.58
	5	158	1310.15
	6	92	1084.17
	7	139	964.37
	8	105	1271.69
	9	143	1442.86
	10	152	917.40
	11	228	1140.42
	12	177	1704.71
	13	96	1023.89
	14	122	1667.49
	15	186	924.05
	16	169	986.67
	Total	2396	

*N = Number of surveys per group.

Mean Rank = ranking of group mean within total number of surveys returned.

Table 85

Singwin r_{F2} Autocorrelation Test For 16 Experiential Intervention Groups

Group	(n)	Observations	r_{F2}=	M	t_{F2} value=	DF	(p)
1	22	13	1.0227	7.95	3.44	17	.003*
2	14	12	0.9153	7.86	2.23	16	.040*
3	10	11	0.3331	8.36	1.77	15	.097
4	14	9	0.0925	7.38	1.66	13	.119
5	16	10	1.0775	8.04	1.62	14	.126
6	11	9	-0.0675	7.81	1.82	13	.091
7	18	8	1.0058	7.71	6.44	12	.000*
8	9	12	0.0467	7.90	2.23	16	.040*
9	12	13	-0.0190	8.31	2.51	17	.022*
10	19	10	-0.6857	7.04	3.79	14	.002*
11	18	13	0.4468	7.89	1.92	17	.071
12	14	13	0.7279	8.57	1.81	17	.088
13	8	13	0.6791	7.74	1.53	14	.146
14	9	14	0.8664	8.52	2.04	18	.055
15	17	12	0.4734	7.42	1.79	16	.092
16	16	11	1.0333	7.63	2.74	15	.015*

* autocorrelation significantly different than zero.

Table 86

Autoregression

Dep. Variable (Autoregression)	B	SEB	t-Ratio	Approx. Probability
(AR1) Time	.1480187	.02035505	7.277872	.000
(AR1) Leadership	.2132378	.02004779	10.636473	.000 *
(AR1) Comfort	.2145362	.01998268	10.736112	.000 *
(AR1) Trust	.2106827	.01999094	10.538908	.000 *
(AR1) Respect	.2434713	.01983975	12.271896	.000 *
(AR1) Honesty	.1825064	.02011745	9.072045	.000 *
(AR1) Sharing	.2027126	.02002661	10.122163	.000 *
(AR1) Cohesion	.2434519	.01987994	12.246110	.000 *

* Variable where leader number was found to be a significant variable.

Table 87

Communalities

	Initial	Extraction
TIME	.439	.341
LEADERSHIP	.480	.377
COMFORT	.409	.365
TRUST	.655	.644
RESPECT	.637	.619
HONESTY	.698	.704
SHARING	.657	.597
COHESION	.691	.691

Extraction Method: Principal Axis Factoring.

Table 88

Total Variance Explained

Factor	Initial Eigenvalues Total	% of Variance	Cumulative %	Extraction Sums of Squared Loadings Total	% of Variance	Cumulative %
1	4.763	59.535	59.535	4.339	54.239	54.239
2	.959	11.991	71.526			
3	.710	8.879	80.406			
4	.480	6.002	86.408			
5	.365	4.561	90.969			
6	.302	3.775	94.744			
7	.241	3.018	97.761			
8	.179	2.239	100.000			

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.

Table 89

Factor Matrix

	Factor
	1
TIME	.584
LEADERSHIP	.614
COMFORT	.605
TRUST	.803
RESPECT	.787
HONESTY	.839
SHARING	.773
COHESION	.831

Extraction Method: Principal Axis Factoring.

a. 1 factor extracted. 4 iterations required.

Table: 90:

Features and usage of guidelines for graphical representations (page 1 of 3).

Type of graphical representation	**Availability**	**Ease of construction / readability**	**Type of evaluative information conveyed**	**Formatting conventions**	**Usage as suggested in the literature**
Excel: Standard Line Graph	Available in commercial desktop office applications	Template for chart wizard function. Readable with table of values.	Raw scores over time, or aggregated values over time	Limit of 6-8 lines of values to visually interpret results	Graphing a continuous function. (Mackinlay, 1986)
Excel: Standard Deviation Enhanced Line Graph (SDELG)	Available in commercial desktop office applications	Some spreadsheet calculation required. Readable with table of values.	Agreement and difference per time of observation within time series data	Limit to 1 line of average values and upper and lower standard deviation lines	Graphing concordance and variation over time. (Patterson & Basham, in press)
Excel: Area Graph: (Usage guidelines limited to computer/ graphing applications).	Available in commercial desktop office applications	Difficult to discriminate minimal differences in proportional contributions. Moderate spreadsheet calculation required. Readable with table of values.	Ordering of contributing dimensions and determining proportional contributions	Stacked line graphs, layered by highest values to lowest values. Sort variables by standard deviation in descending order to display	Highlighting how much each data range contributes to a total value, and to emphasize total change over time. Useful in showing changes in percentages or cumulative values over time.
Excel: Three Dimensional Surface Plot: Dimensions of Change	Available in commercial desktop office applications	Some spreadsheet calculation required. Ease of readability enhanced in digital format as graphic can be visually rotated and magnified.	Topography of dimensional change over time. Representation may be modified to compare one dimension of change for multiple groups. (Patterson & Basham, in press)	Sort variables by sum in ascending or descending order and digitally rotate graph to display	Display variables on the X and Z horizontal axes and data values of the variables are plotted on the Y-axis, to create the topography on the resultant surface (Yu & Behrens, 1995).

Table: 90: (continued, page 2 of 3).

Type of graphical representation	**Availability**	**Ease of construction / readability**	**Type of evaluative information conveyed**	**Formatting conventions**	**Usage as suggested in the literature**
Excel: Three Dimensional Surface Plot: Individual Subjects	Available in commercial desktop office applications	Some spreadsheet calculation required. Ease of readability enhanced in digital format as graphic can be visually rotated and magnified.	Topography of individual change over time. Representation may be modified to compare one dimension of change for multiple groups. (Patterson & Basham, in press)	Sort variables by sum in ascending or descending order and digitally rotate graph to display	A number of rules emphasize providing perceptual clues (i.e., grid marks, surface lighting, and varying texture, color, and orientation) (Haber, 1988; Tufte, 1983).
SPSS: Histogram	Available in academic research software of limited availability to practitioners	Easy to construct with appropriate statistical software. Readable with values given.	Graphical summarization of the distribution of a univariate data set. Distribution of values relative to a distribution curve. Mean, standard deviation, and N of observations or cases given	Scale the x and y-axis to the same metric for multiple histograms when seeking to make visual comparisons.	Appearance of the histogram is controlled by the number of bars used to depict the data Presents the data center; data spread; data skewness; presence of outliers; and presence of multiple modes in the data. (Chambers et al., 1983)
SPSS: Scatterplot to Evaluate Linearity	Available in academic research software of limited availability to practitioners	Easy to construct with appropriate software and advanced statistical training. Readable with some orientation.	Diagnostic graphic of linearity. Points clustering around a straight line suggest a linear relationship between the independent and dependent variable.	Studentized residuals and predicted values plotted on the y and x axes.	The plot represents a point cloud. The main message is the pattern of distribution of values. (Tukey, 1988b)

Table: 90: (continued, page 3 of 3).

Type of graphical representation	**Availability**	**Ease of construction / readability**	**Type of evaluative information conveyed**	**Formatting conventions**	**Usage as suggested in the literature**
SPSS: Scatterplot to Evaluate Independence	Available in academic research software of limited availability to practitioners	Easy to construct with appropriate software and advanced statistical training. Readable with some orientation.	Diagnostic graphic of independence. Points clustering around a straight line suggest a linear relationship between the independent and dependent variable.	Studentized residuals and the sequence variable plotted on the y and x axes. Durbin-Watson test used to determine correlation of adjacent observations.	The plot represents a point cloud. The main message is the pattern of distribution of values. (Tukey, 1988b)
SINGWIN: Moving Average Line Graph	Available as companion software for textbook cited.	Difficult to import spreadsheet data. Manual data entry is time consuming. Readable , but significance testing needed.	Autocorrelation in time series with few observations. Single subject evaluation.	Create a line graph of intervention data points over time. Compute the moving average transformation and create a comparison line graph.	Plots the mean of adjacent data points. Smoothing of data through data transformation. (Bloom et al., 1999)
SPC Charts: X-Bar R-Chart	Available from authors. Requires Excel template or alternate statistical program to construct.	When entering your own data, it may be necessary to change the format of the vertical axis (y-axis) Readable with values given. *(see below)	Detection of changes in process mean over time and assumes that process variability is the same over time.	Compute the mean and range, mean of the means, mean range, estimate of the population standard deviation of the mean, UCL $_{\&}$ LCL.	Preferred to be used with an outcome variable having continuous data, and equal samples with an n = 2 to 10 (Orme & Cox, 2001)
SPC Charts: R-Chart	Available from authors. Requires Excel template or alternate statistical program to construct.	When using the R-chart, it is necessary to change the formulas for UCL and LCL lines to reflect the number of scores per time period.*	Detects changes in variability over time based on range of values and assumes that process variability is the same over time.	Compute the range, mean sample range, estimate of the population standard deviation of mean range, UCL $_{\&}$ LCL.	Preferred to be used with an outcome variable having continuous data, and equal samples with an n = 2 to 10 (Orme & Cox, 2001)

Appendix B: Figures

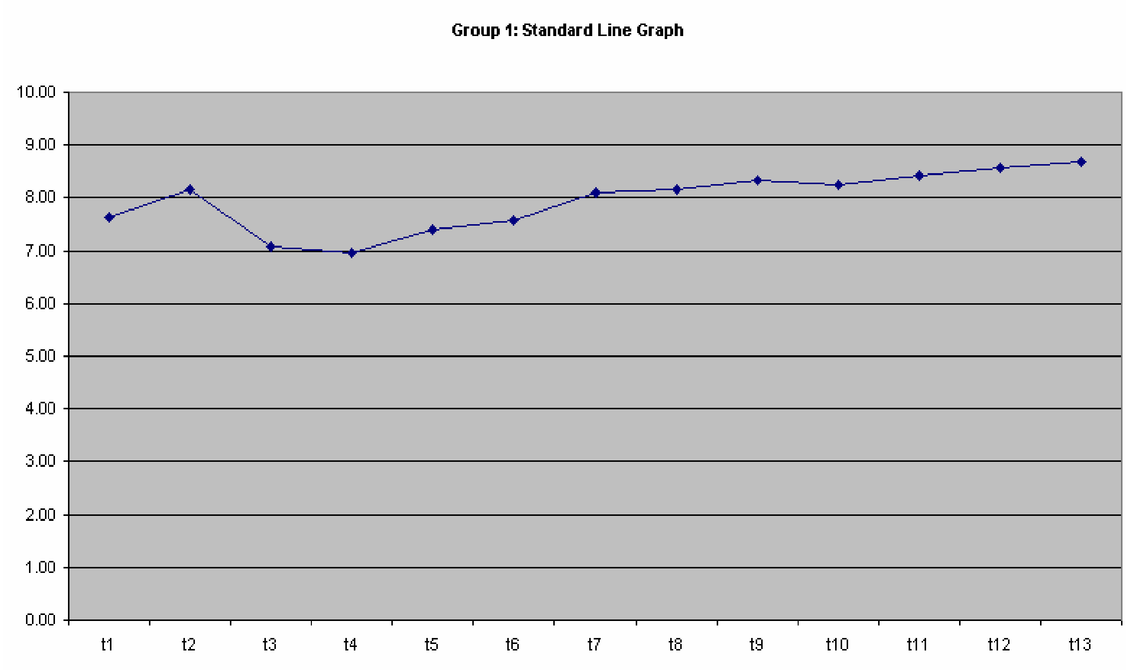


Figure 1. Group 1 (Excel)-Standard line graph: Average satisfaction across weeks.

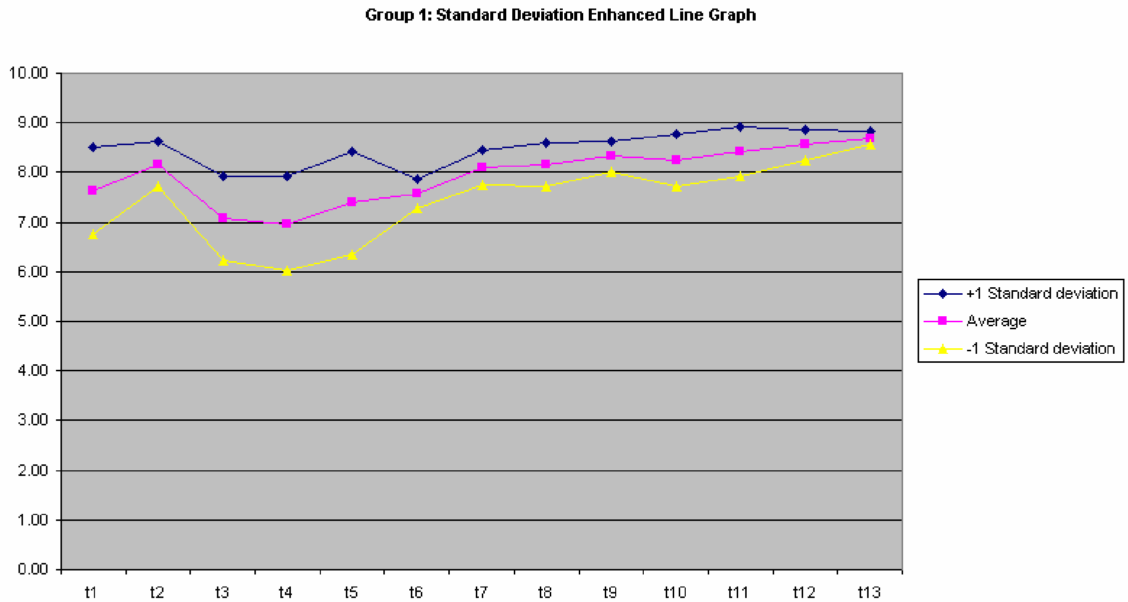


Figure 2. Group 1 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

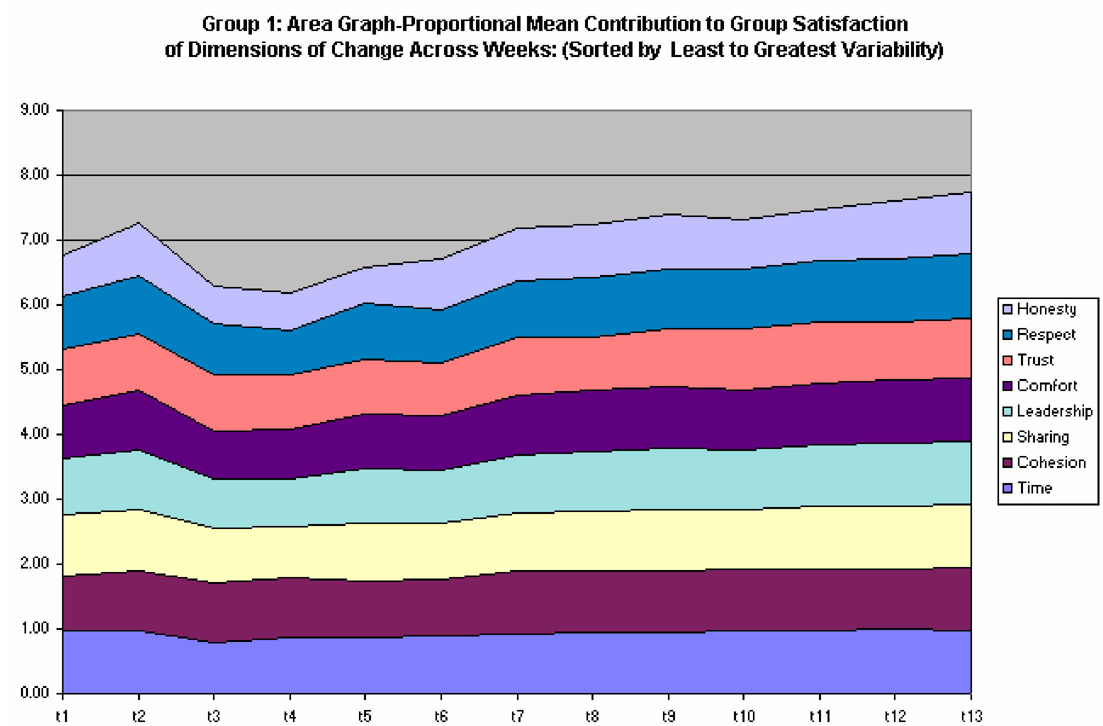


Figure 3. Group 1 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

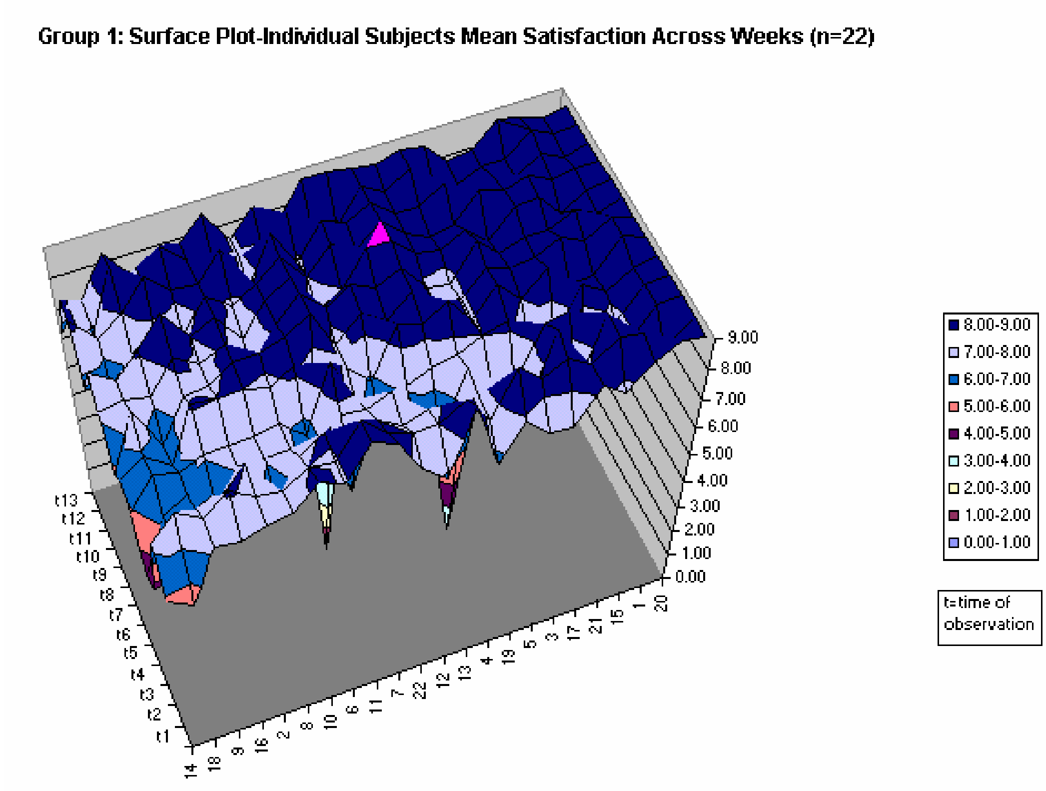


Figure 4. Group 1 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

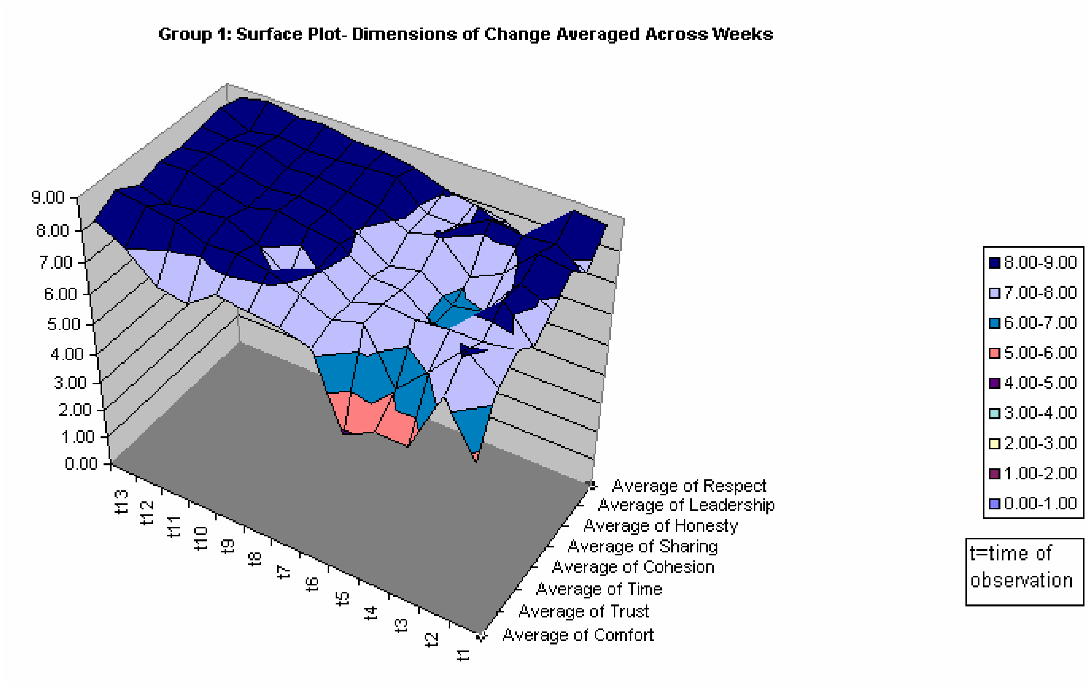


Figure 5. Group 1 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

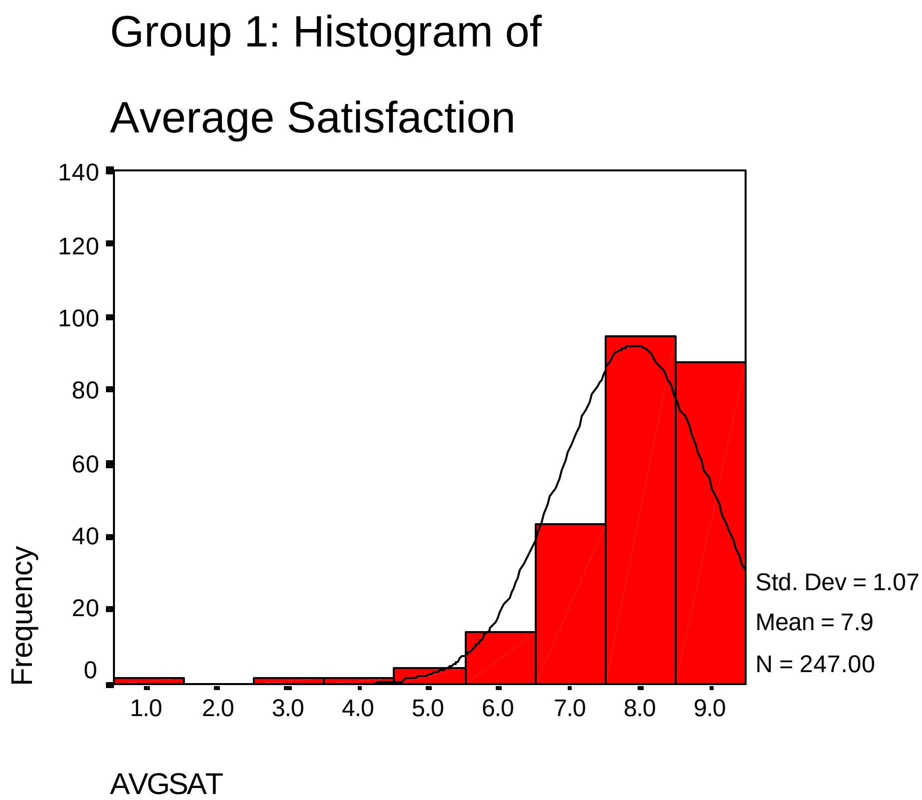


Figure 6. Group 1 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

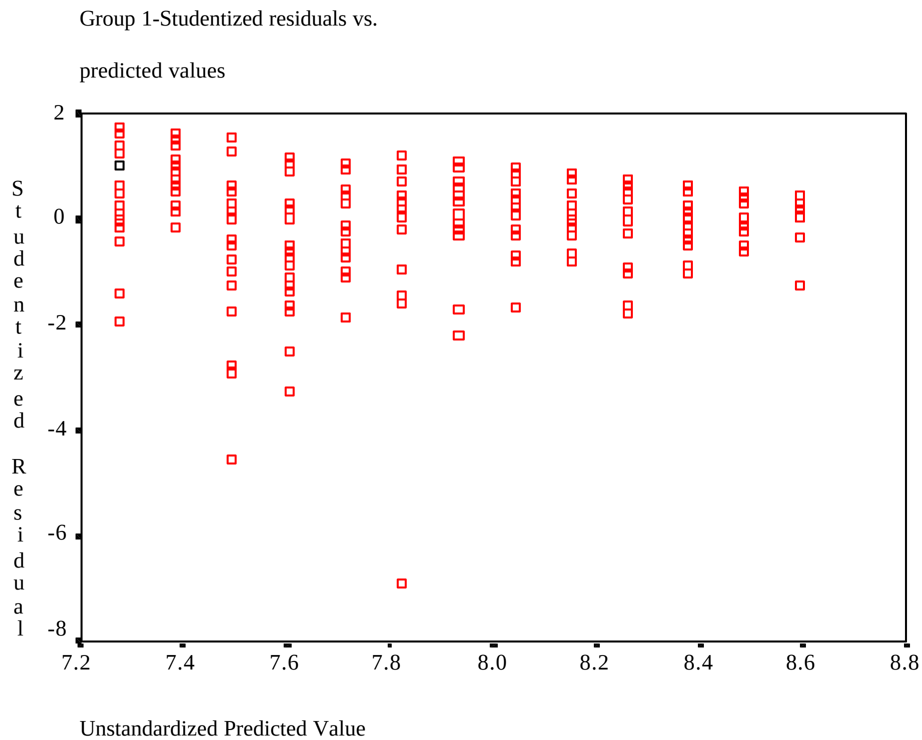


Figure 7. Group 1 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

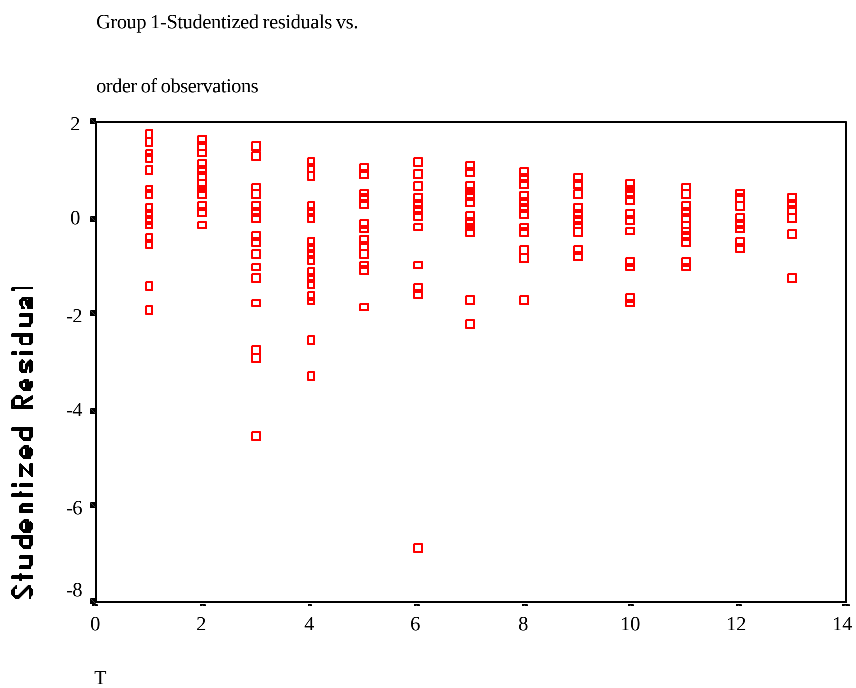


Figure 8. Group 1 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

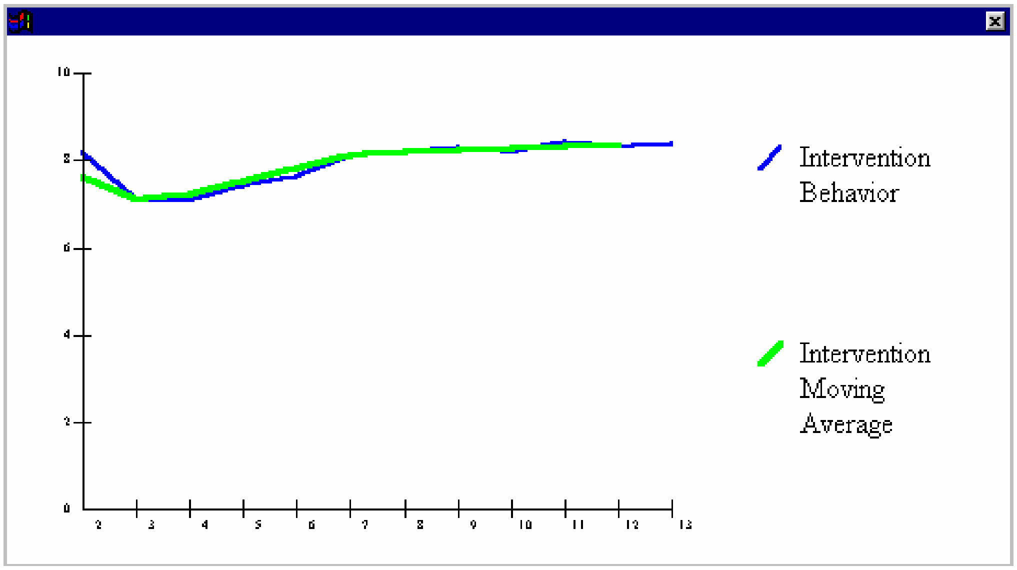


Figure 9. Group 1 (Singwin)-Moving average line: The intervention phase of group measurement.

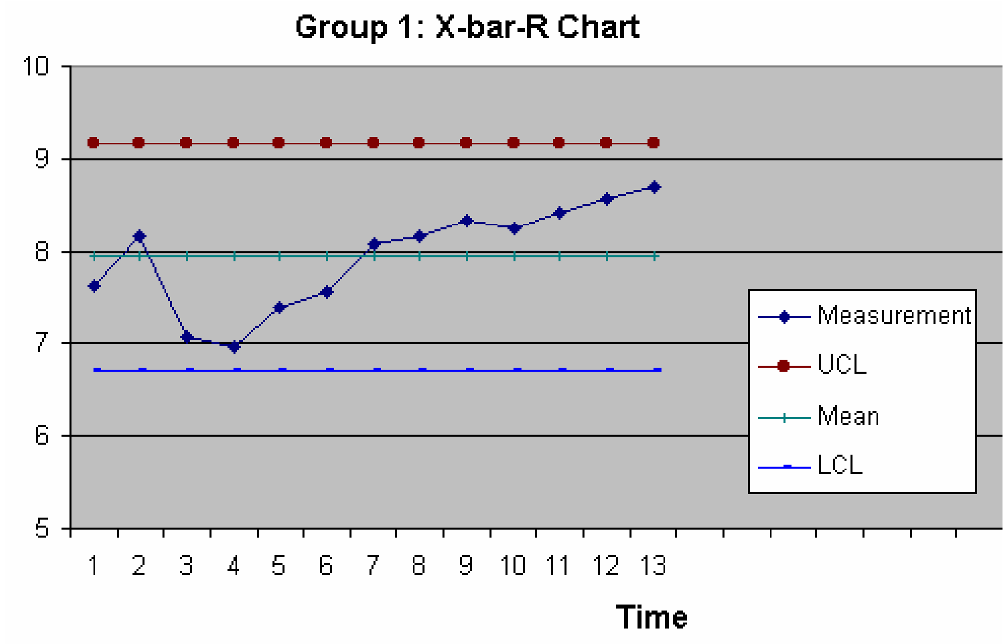


Figure 10. Group 1 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

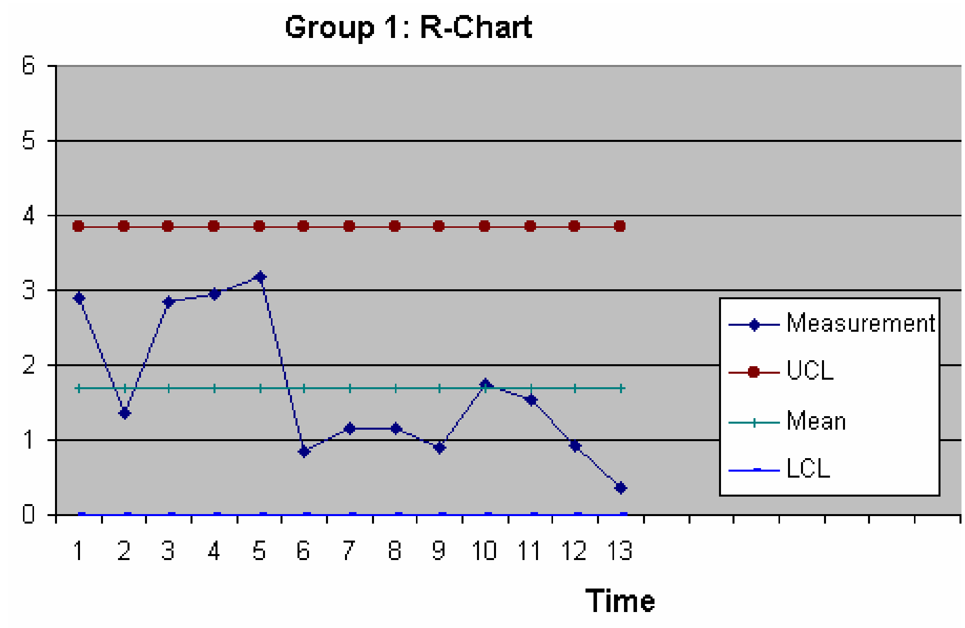


Figure 11. Group 1 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

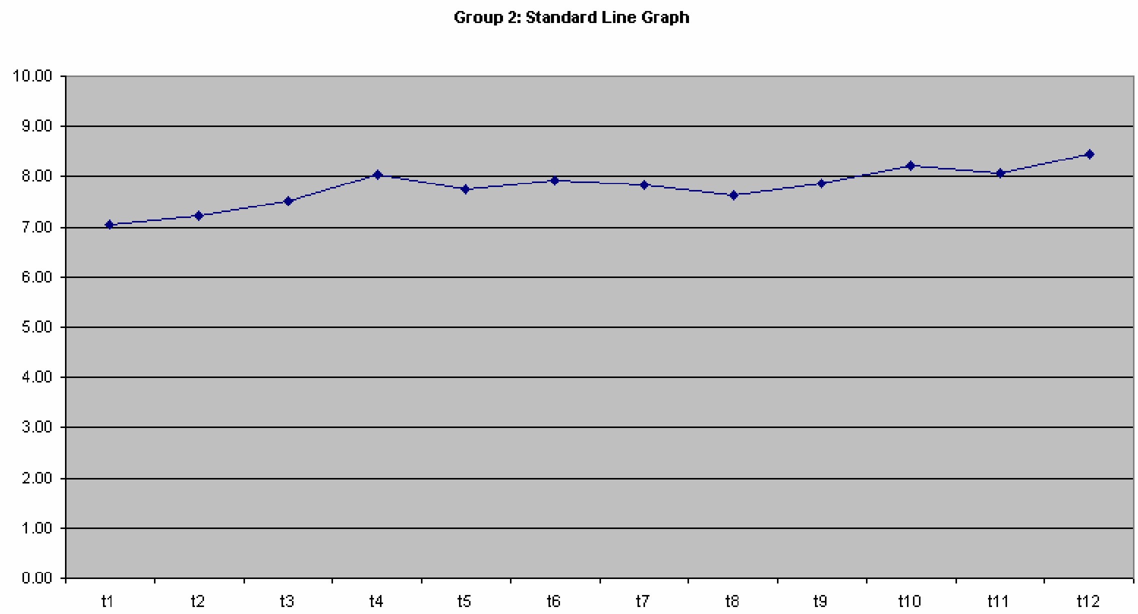


Figure 12. Group 2 (Excel)-Standard line graph: Average satisfaction across weeks.

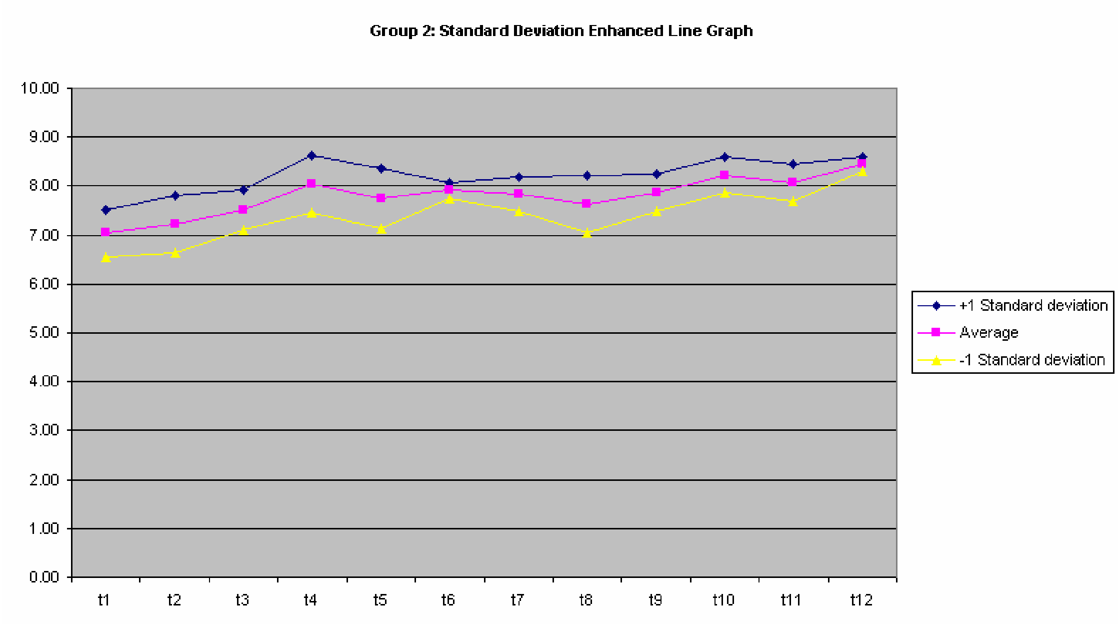


Figure 13. Group 2 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

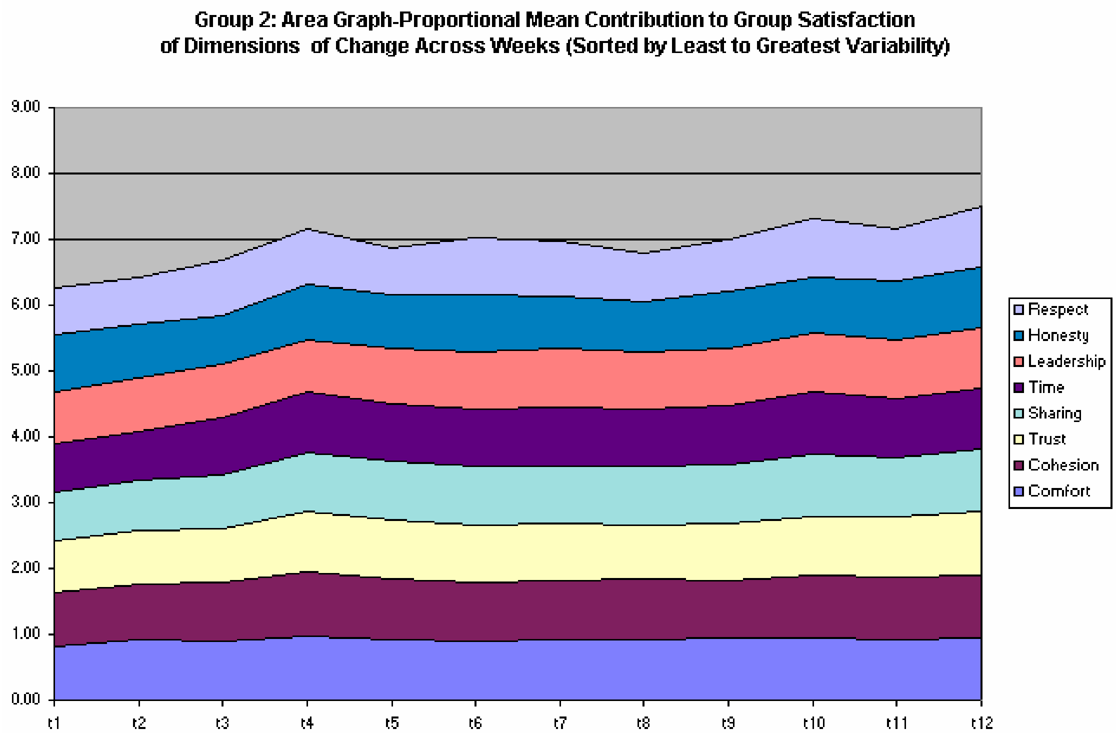


Figure 14. Group 2 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

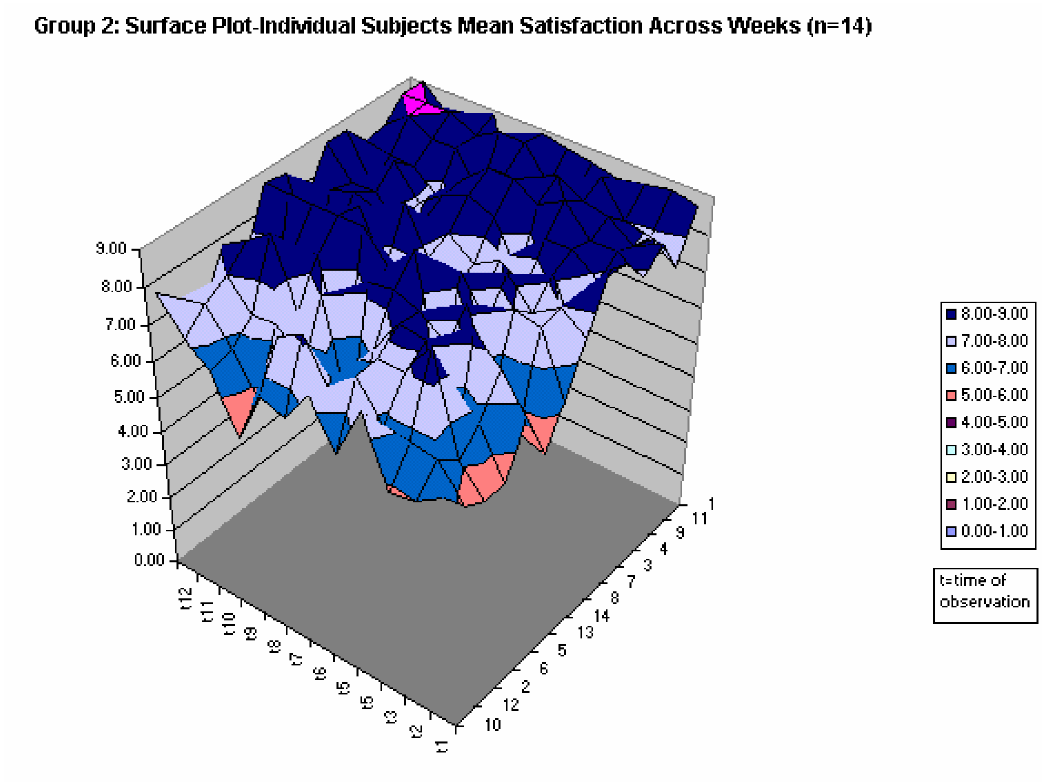


Figure 15. Group 2 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

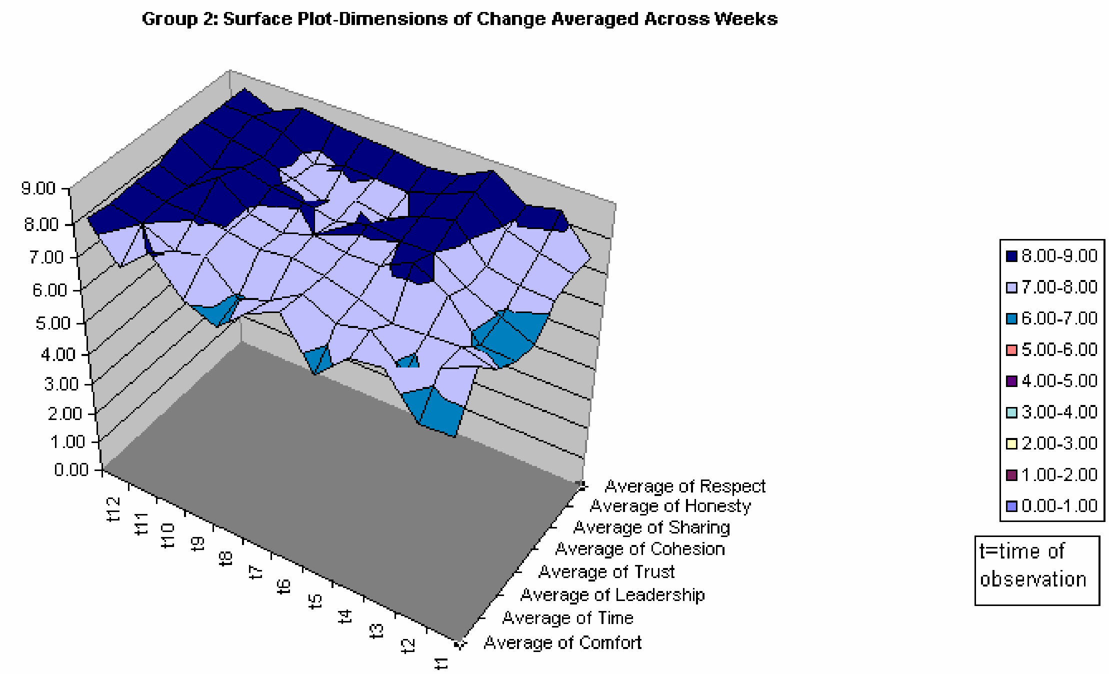


Figure 16. Group 2 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

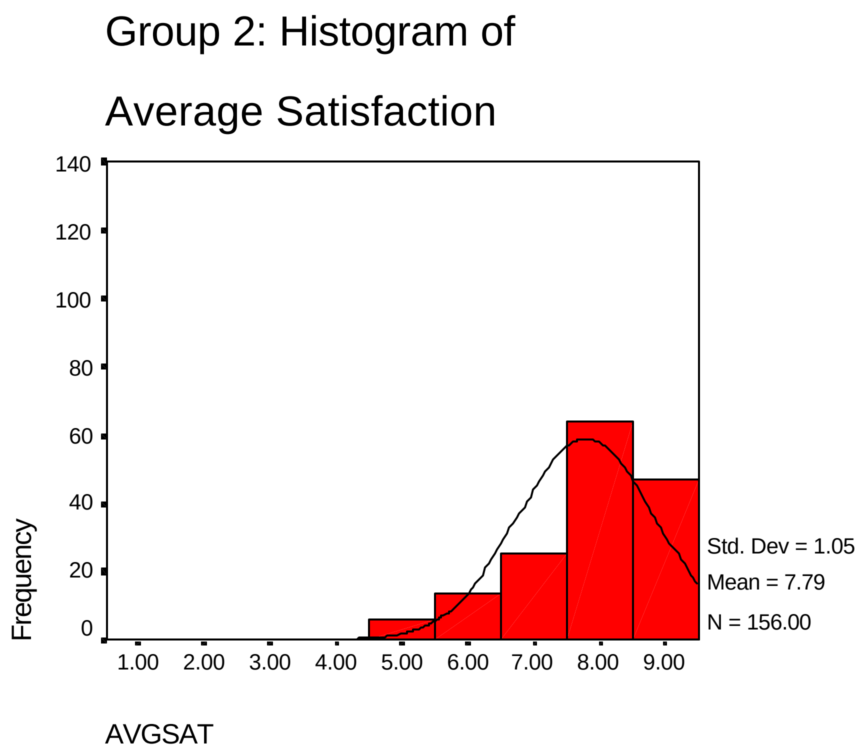


Figure 17. Group 2 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

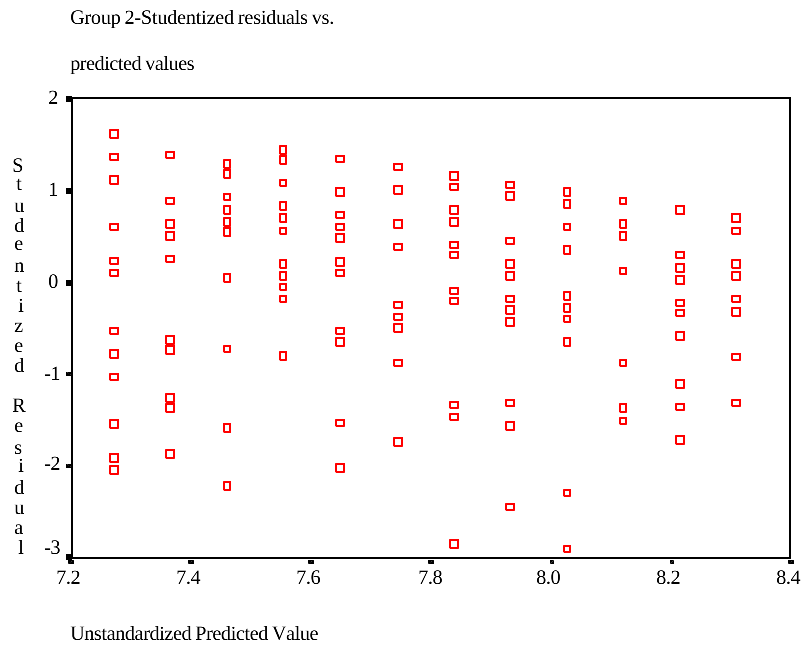


Figure 18. Group 2 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

Figure 19. Group 2 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

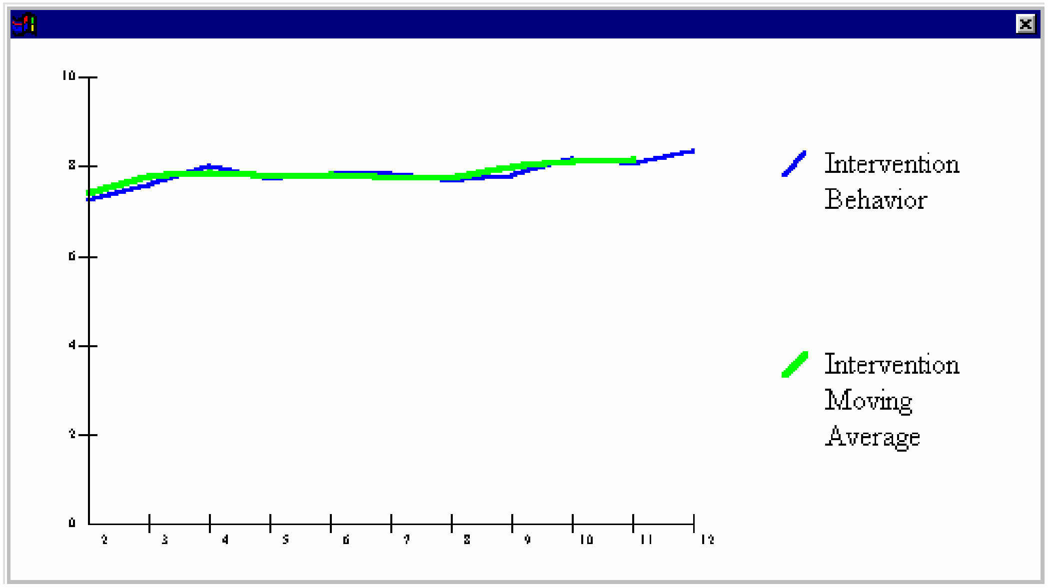


Figure 20. Group 2 (Singwin)-Moving average line: The intervention phase of group measurement.

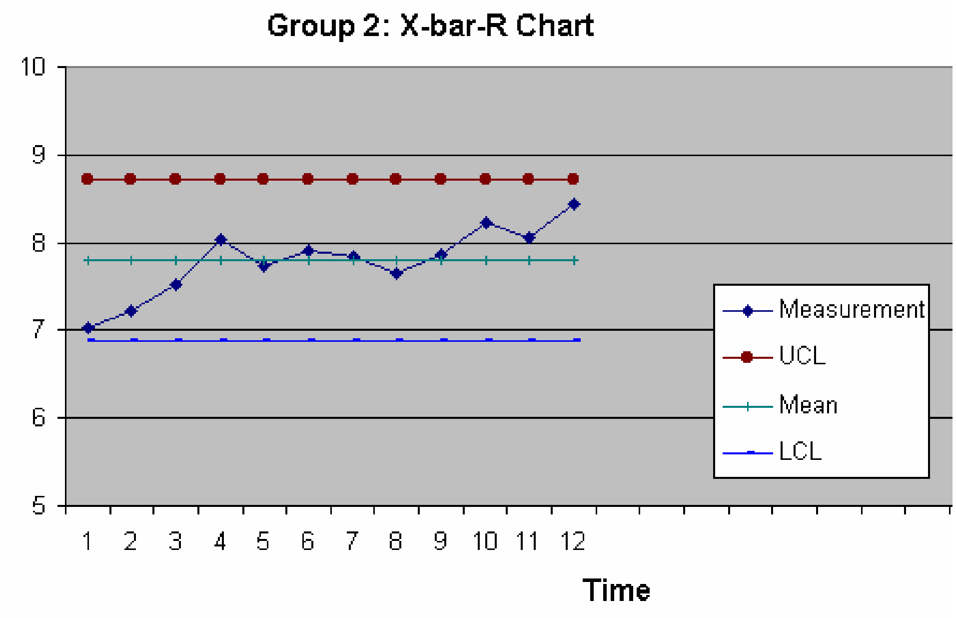


Figure 21. Group 2 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

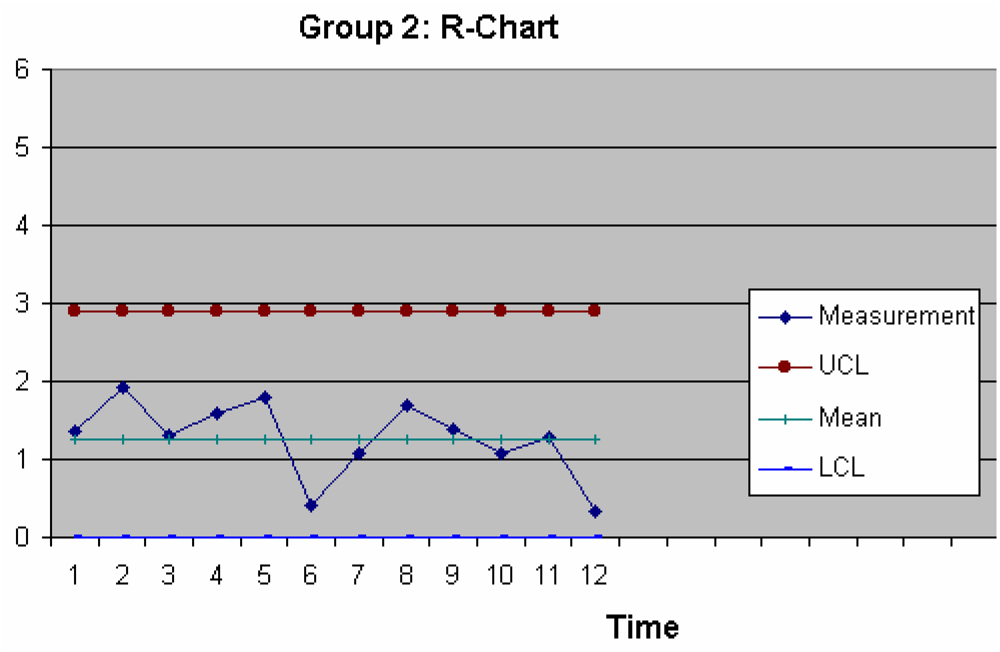


Figure 22. Group 2 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

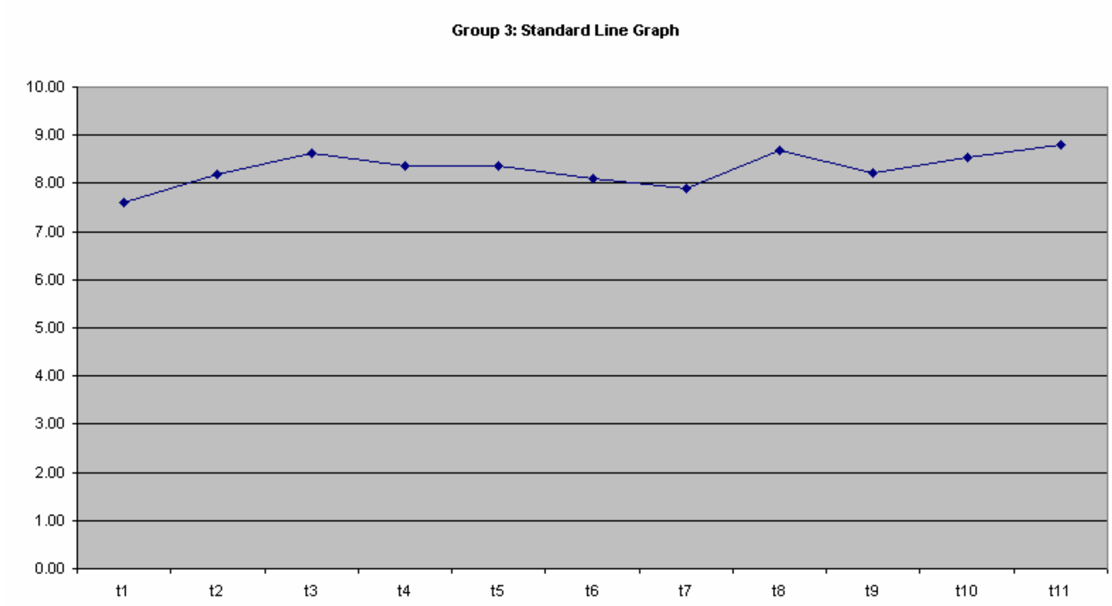


Figure 23. Group 3 (Excel)-Standard line graph: Average satisfaction across weeks.

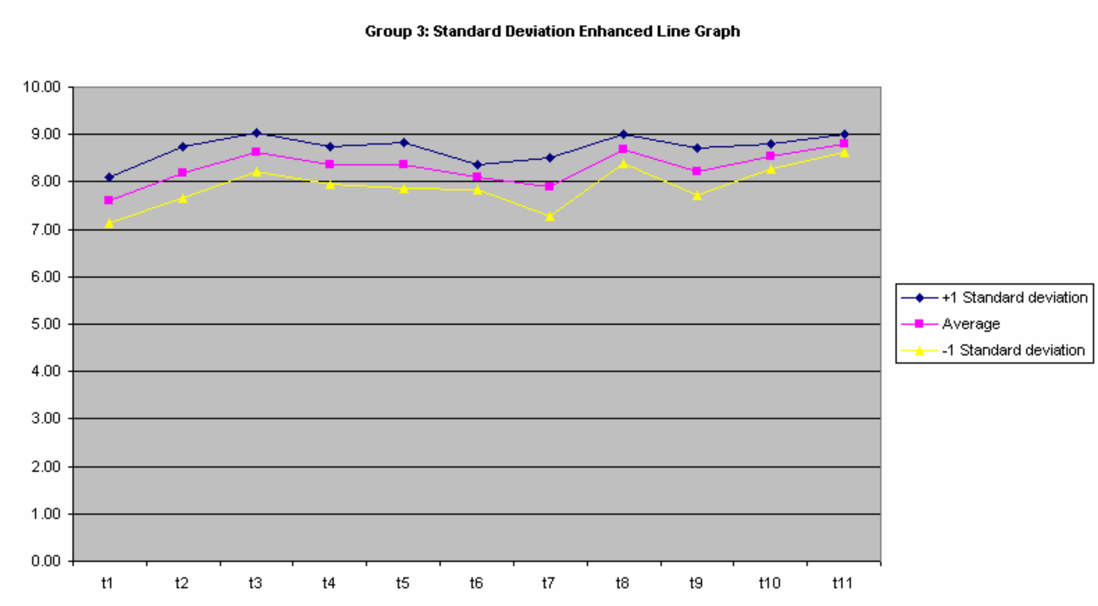


Figure 24. Group 3 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

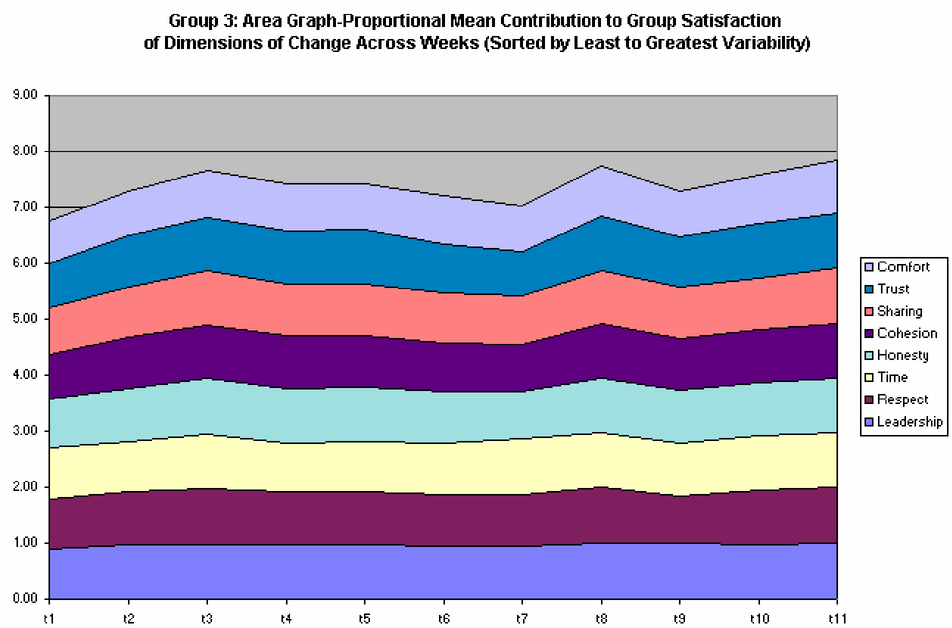


Figure 25. Group 3 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

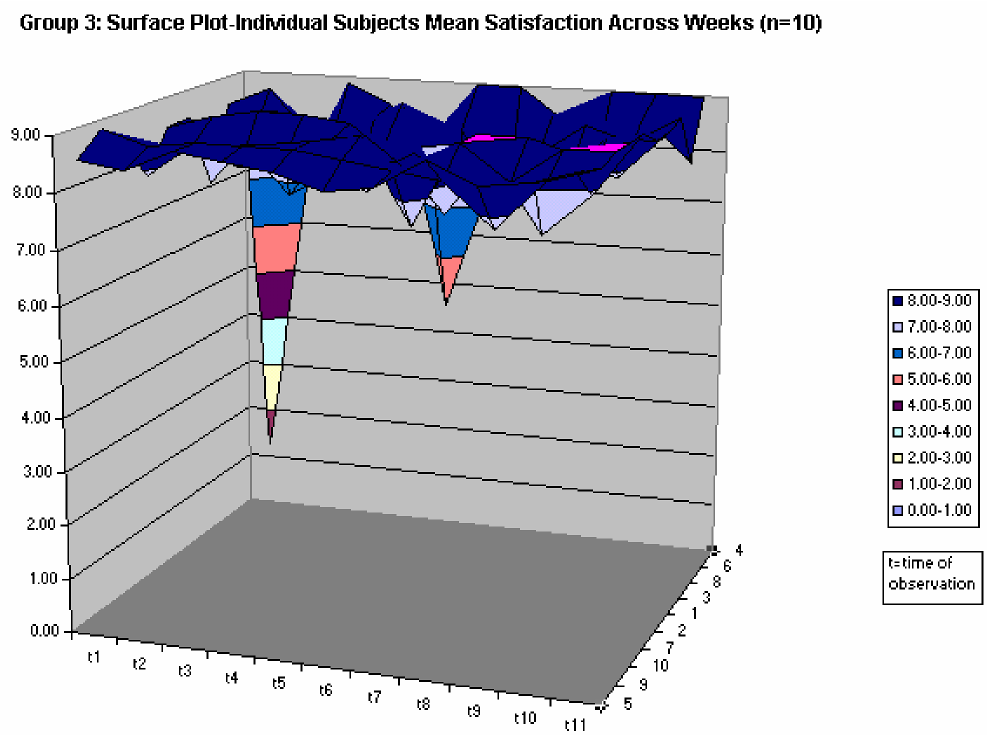


Figure 26. Group 3 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

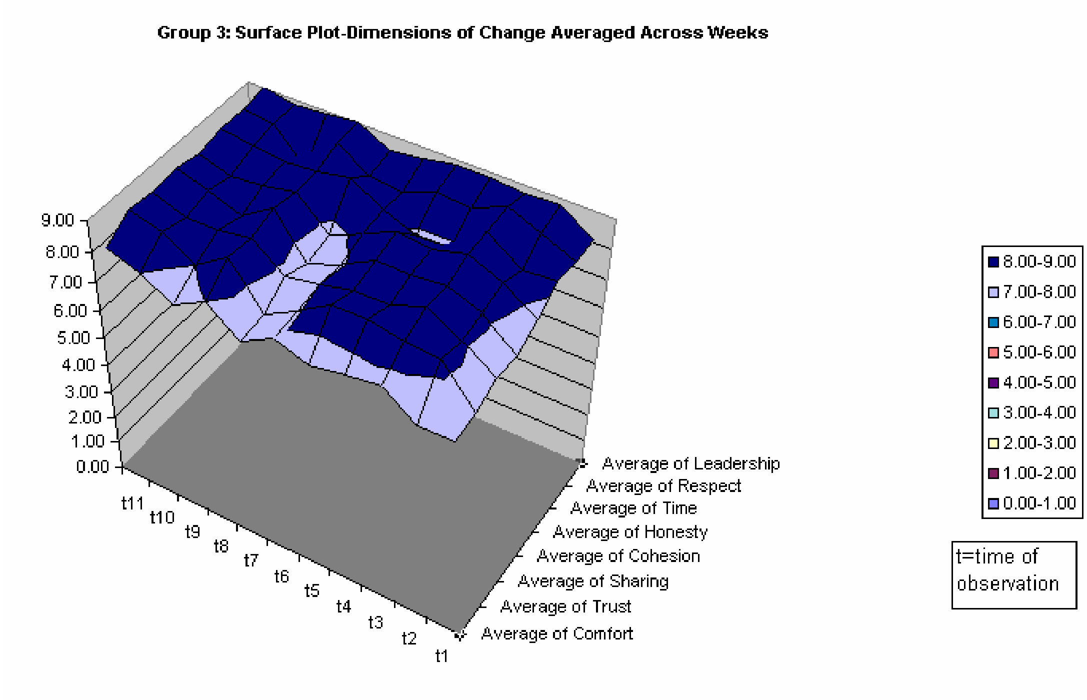


Figure 27. Group 3 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

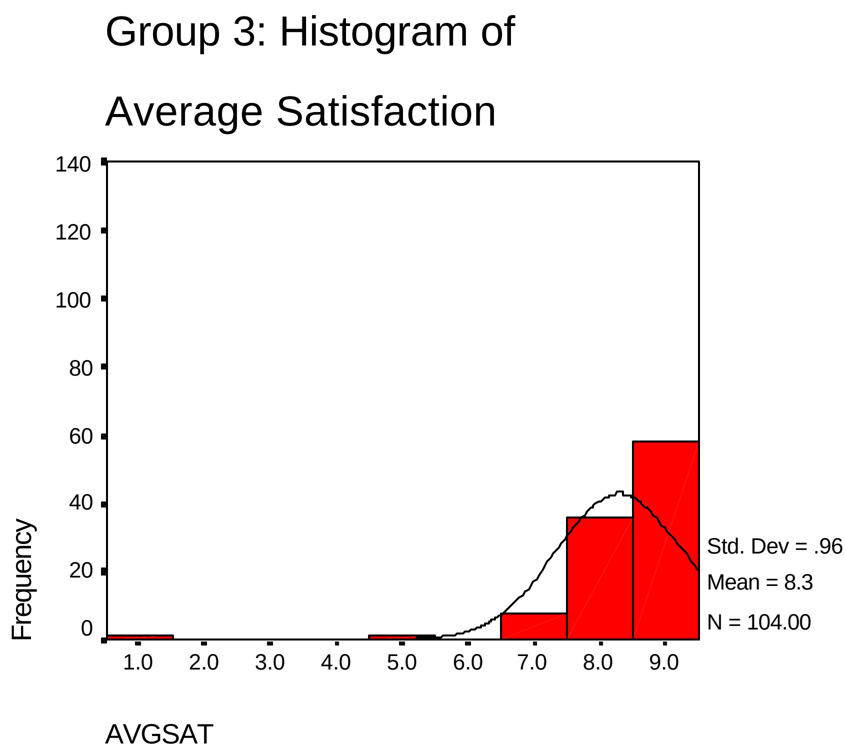


Figure 28. Group 3 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

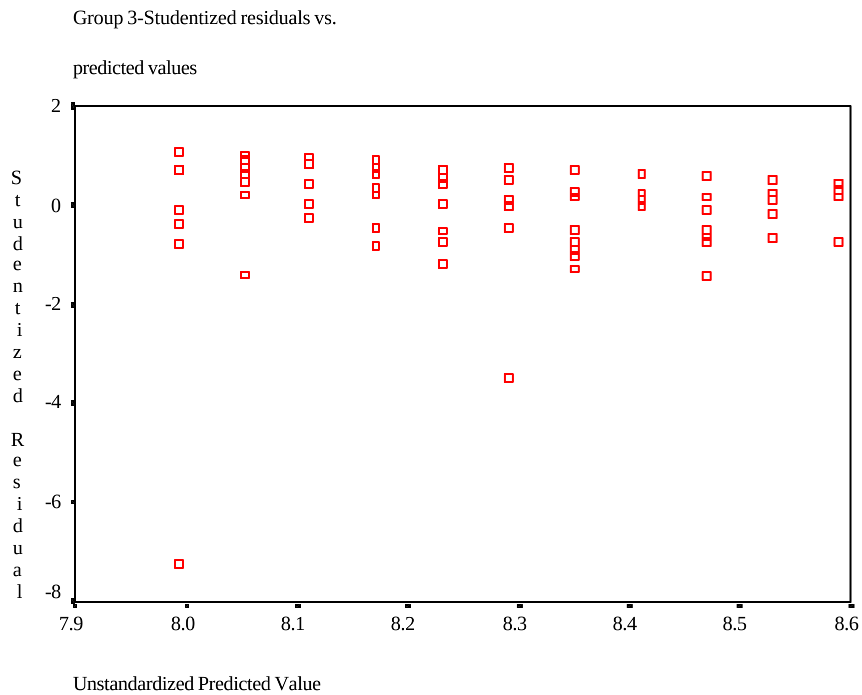


Figure 29. Group 3 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

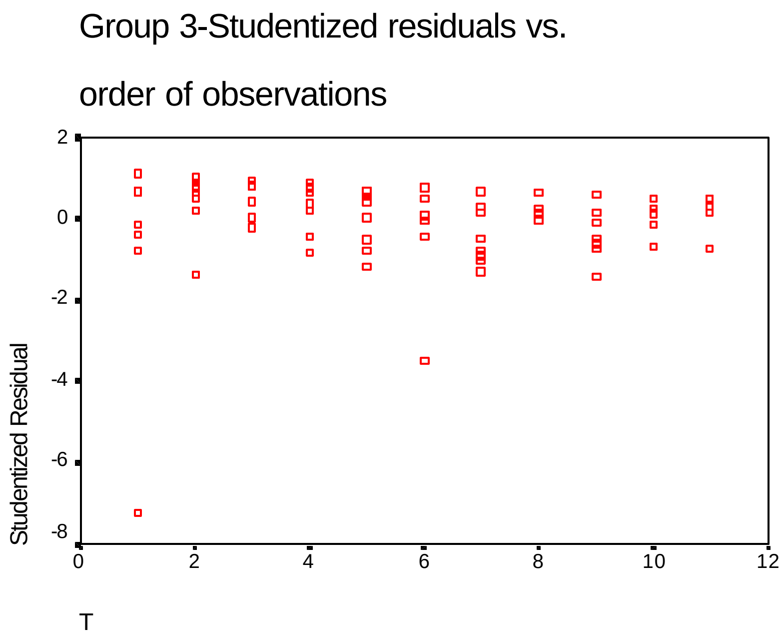


Figure 30. Group 3 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

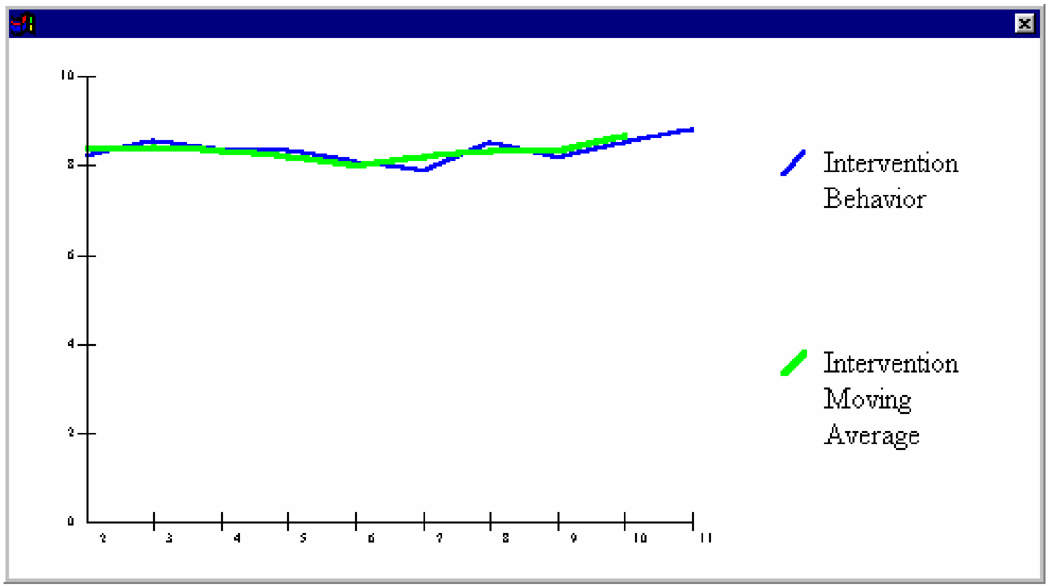


Figure 31. Group 3 (Singwin)-Moving average line: The intervention phase of group measurement.

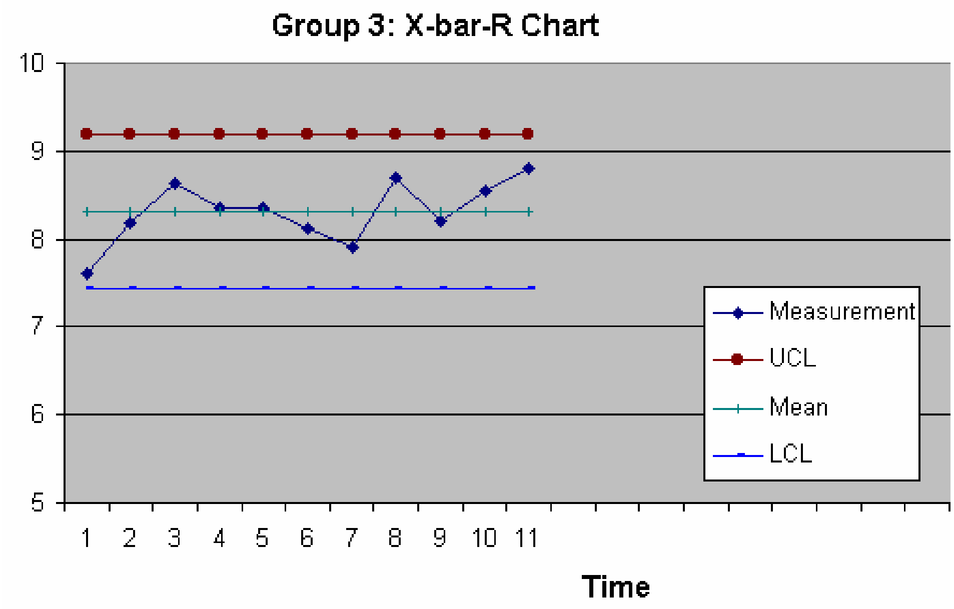


Figure 32. Group 3 (Excel add-on)-Data for the statistical process control (SPC) chart: X-Bar–R chart.

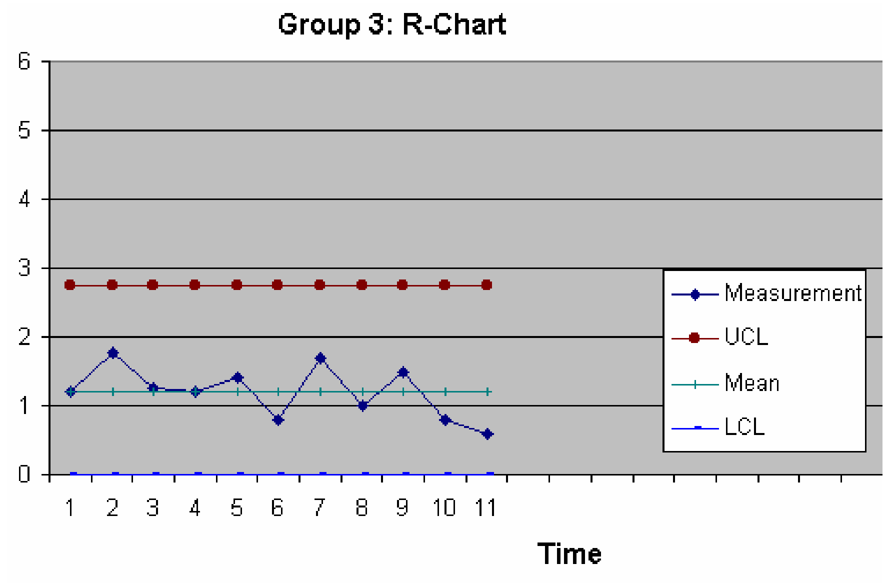


Figure 33. Group 3 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

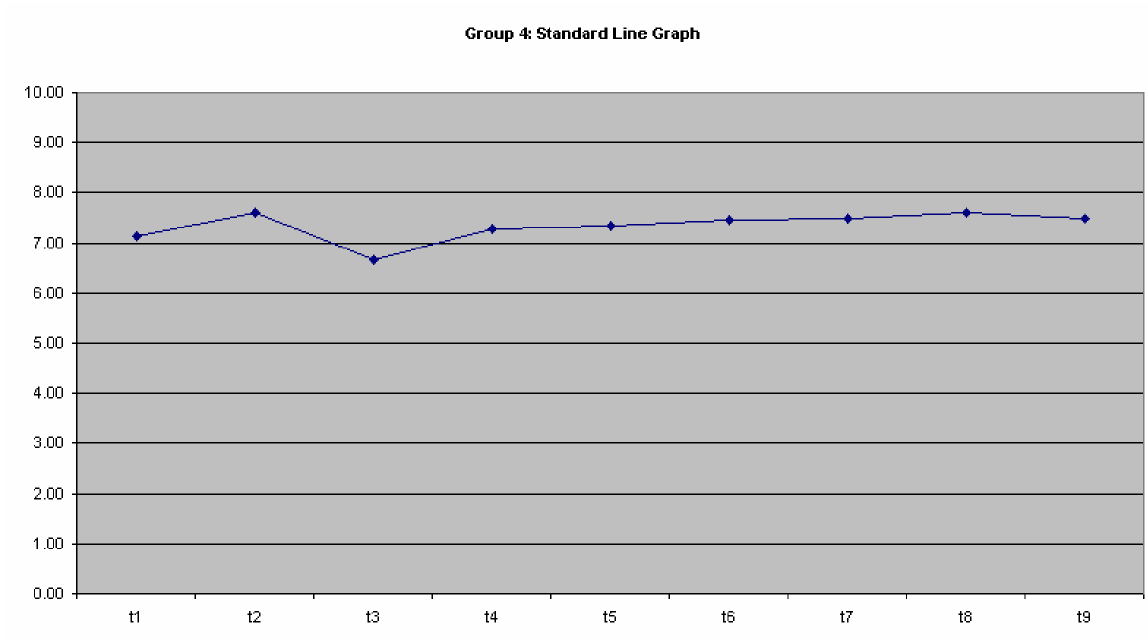


Figure 34. Group 4 (Excel)-Standard line graph: Average satisfaction across weeks.

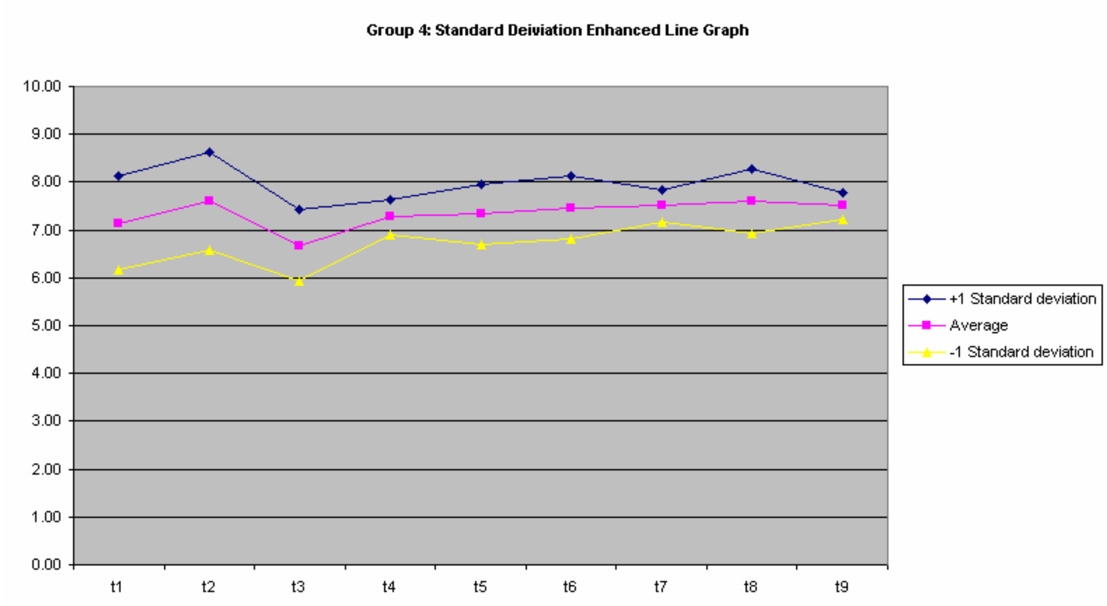


Figure 35. Group 4 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

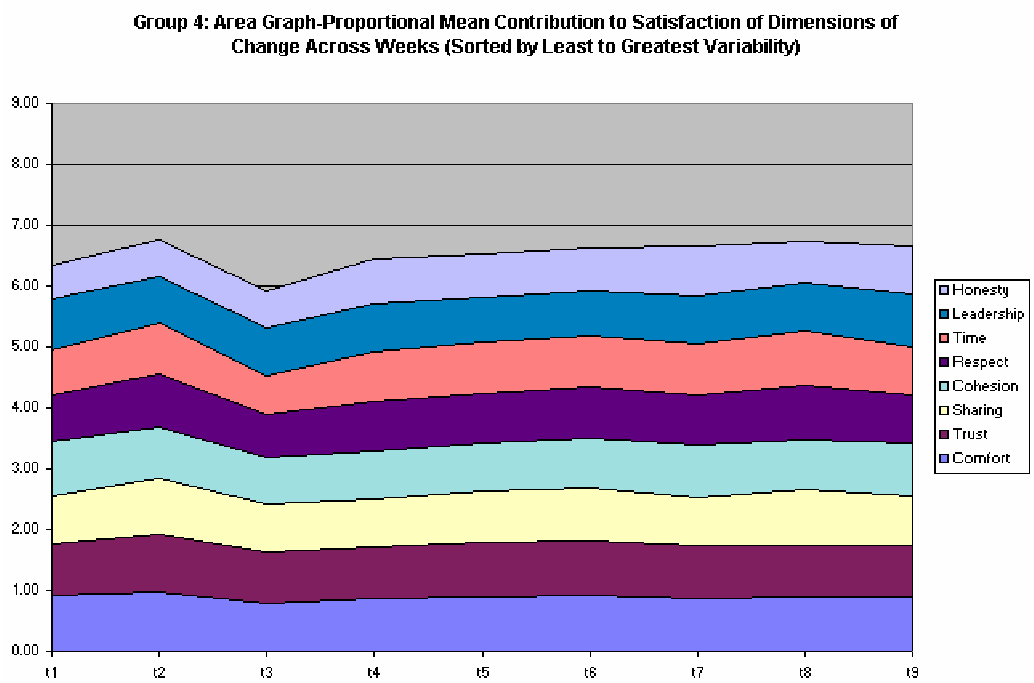


Figure 36. Group 4 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

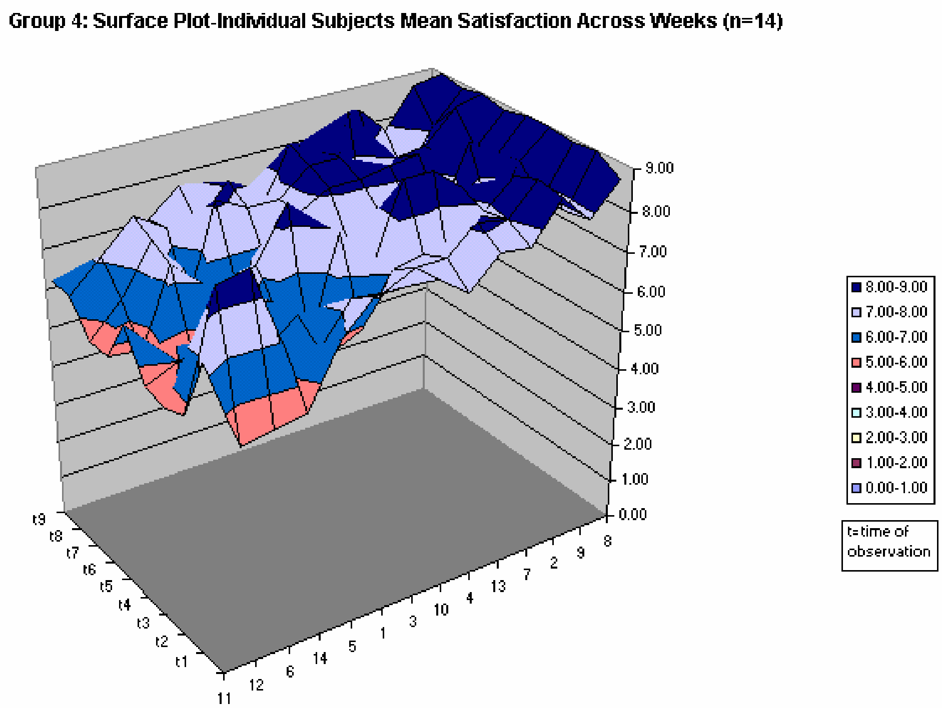


Figure 37. Group 4 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

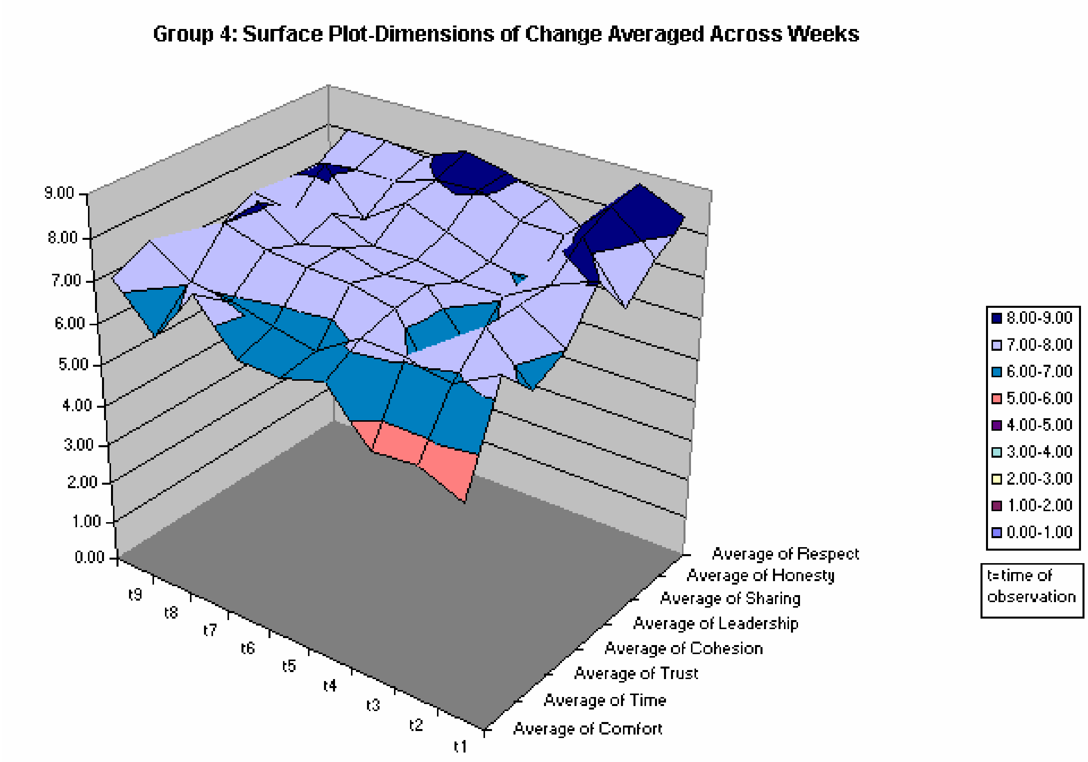


Figure 38. Group 4 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

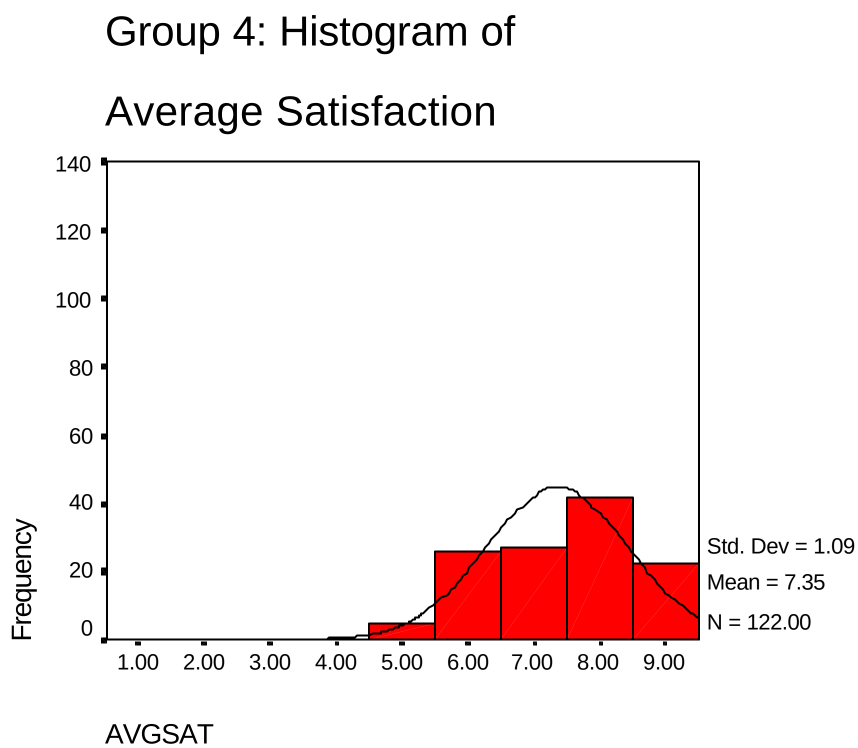


Figure 39. Group 4 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

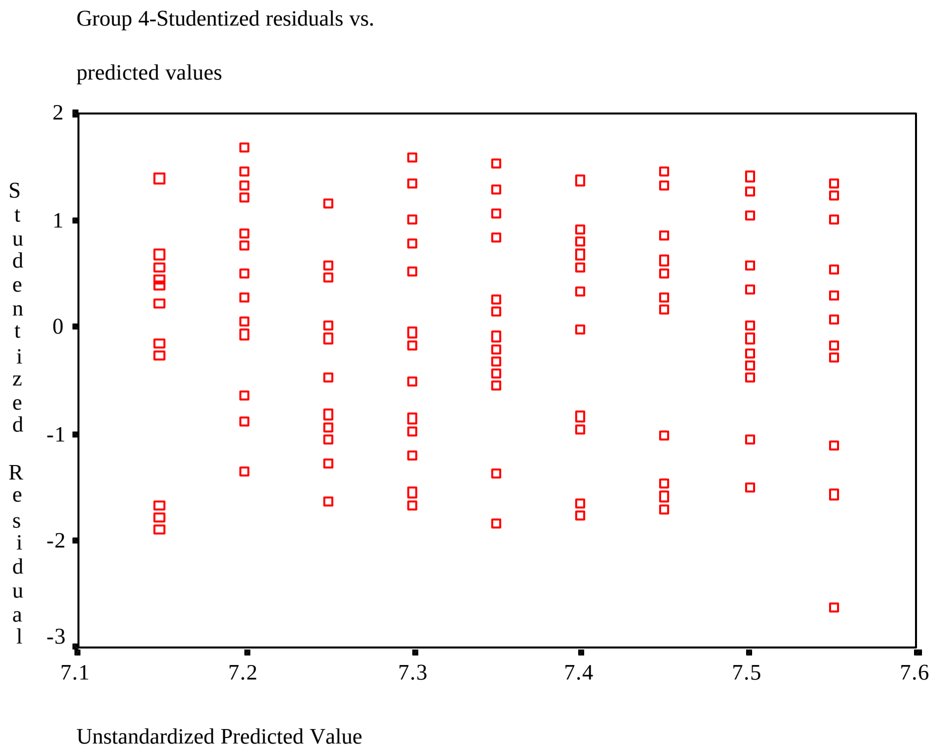


Figure 40. Group 4 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

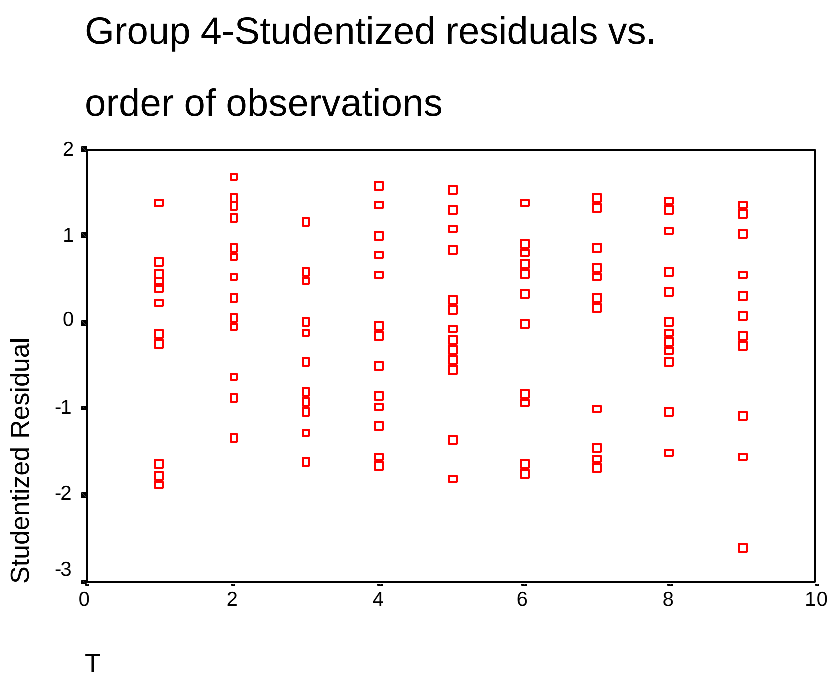


Figure 41. Group 4 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

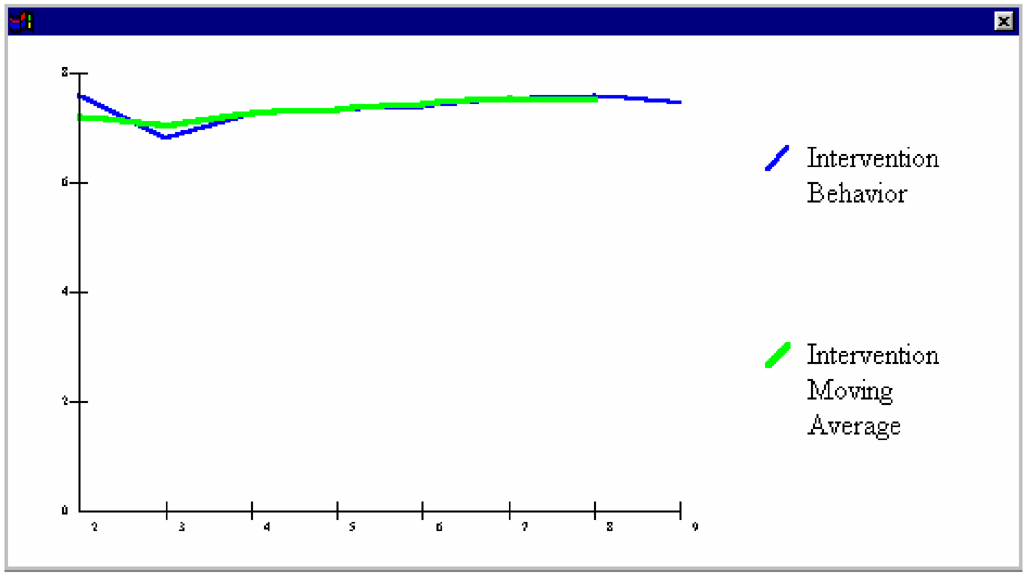


Figure 42. Group 4 (Singwin)-Moving average line: The intervention phase of group measurement.

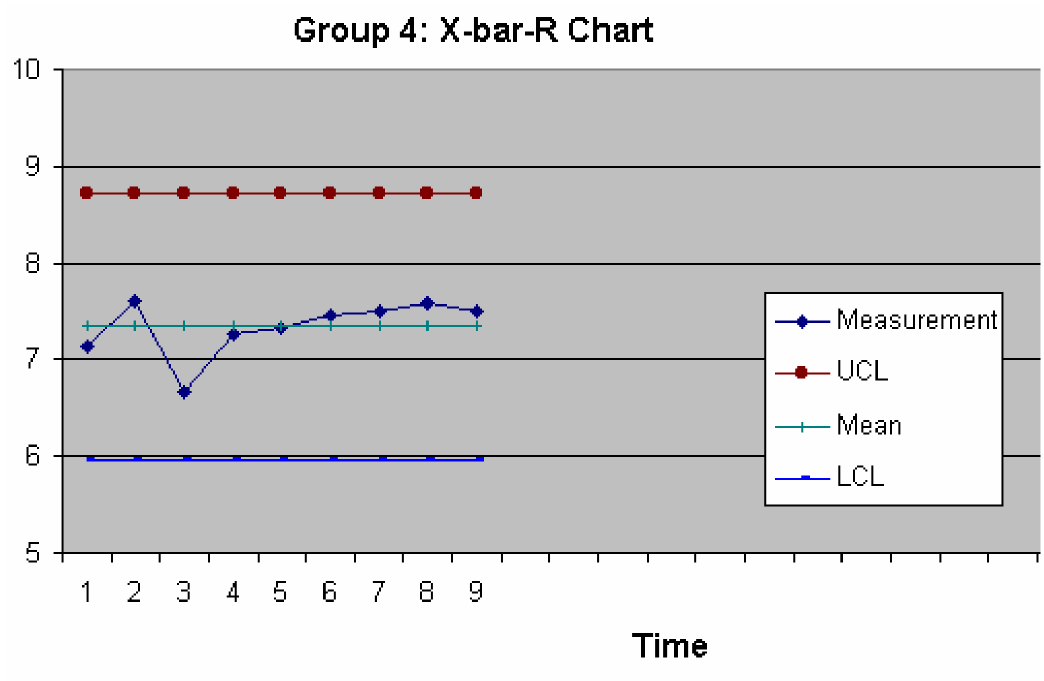


Figure 43. Group 4 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

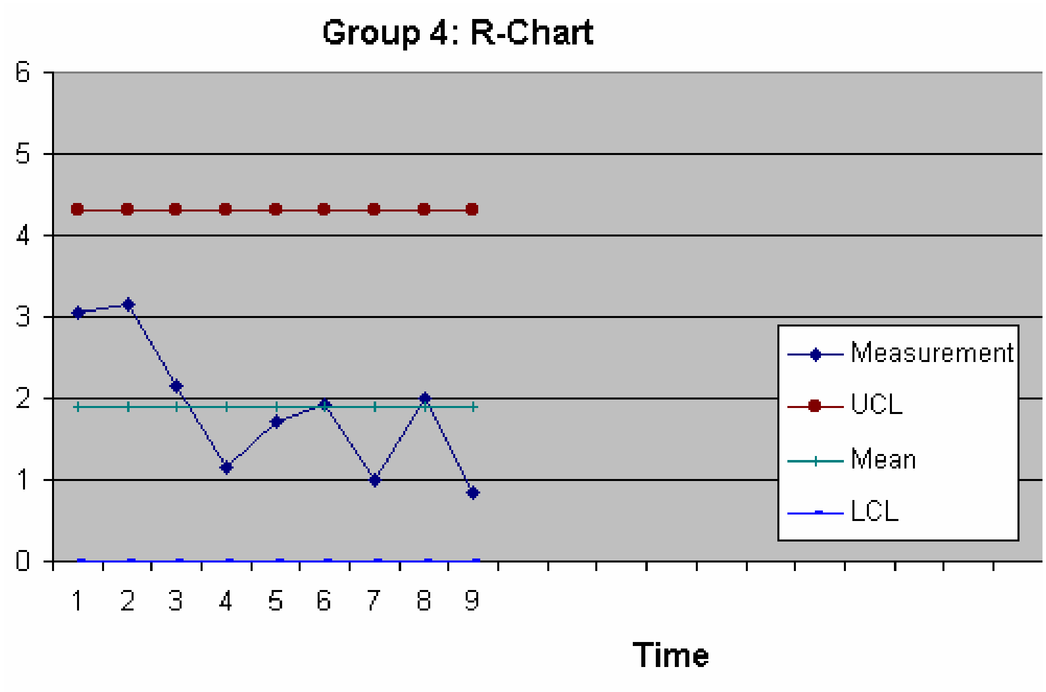


Figure 44. Group 4 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

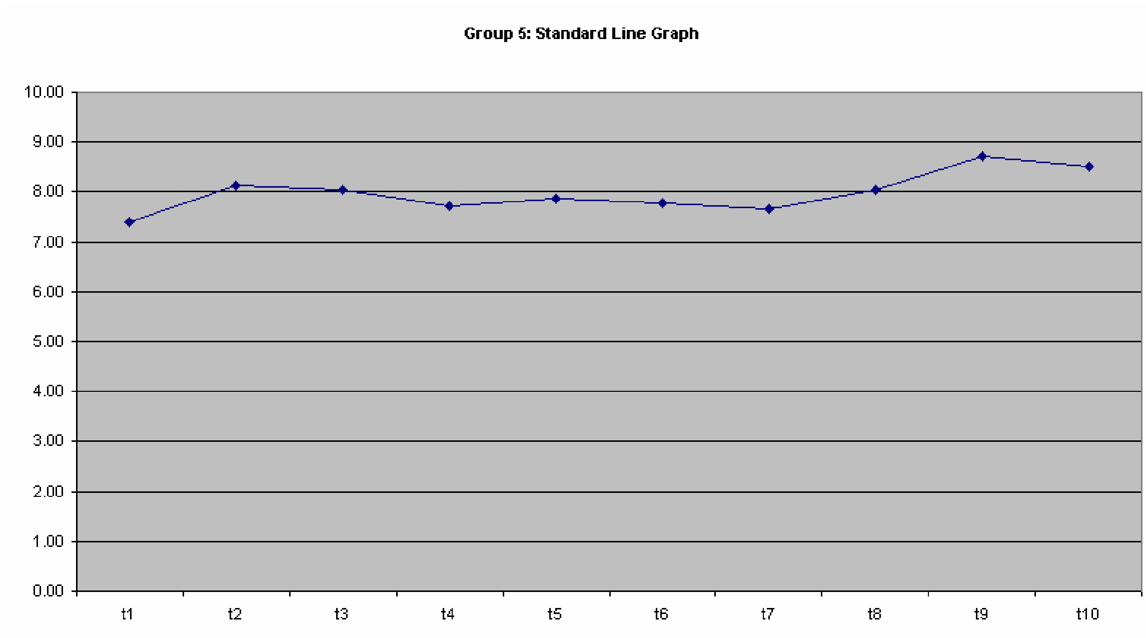


Figure 45. Group 5 (Excel)-Standard line graph: Average satisfaction across weeks.

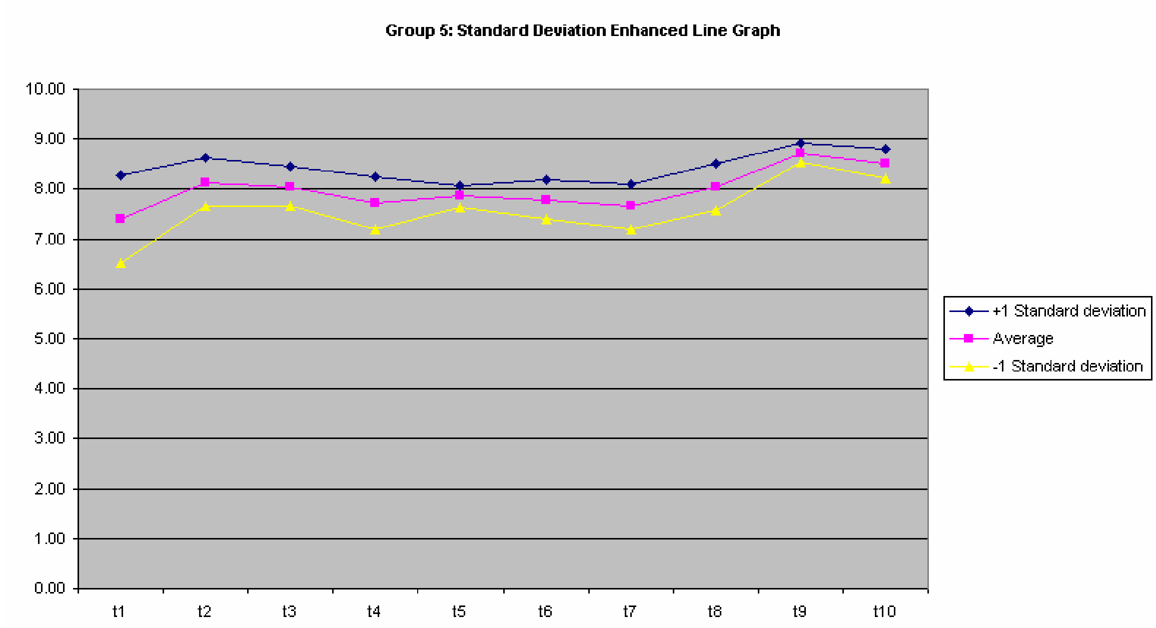


Figure 46. Group 5 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

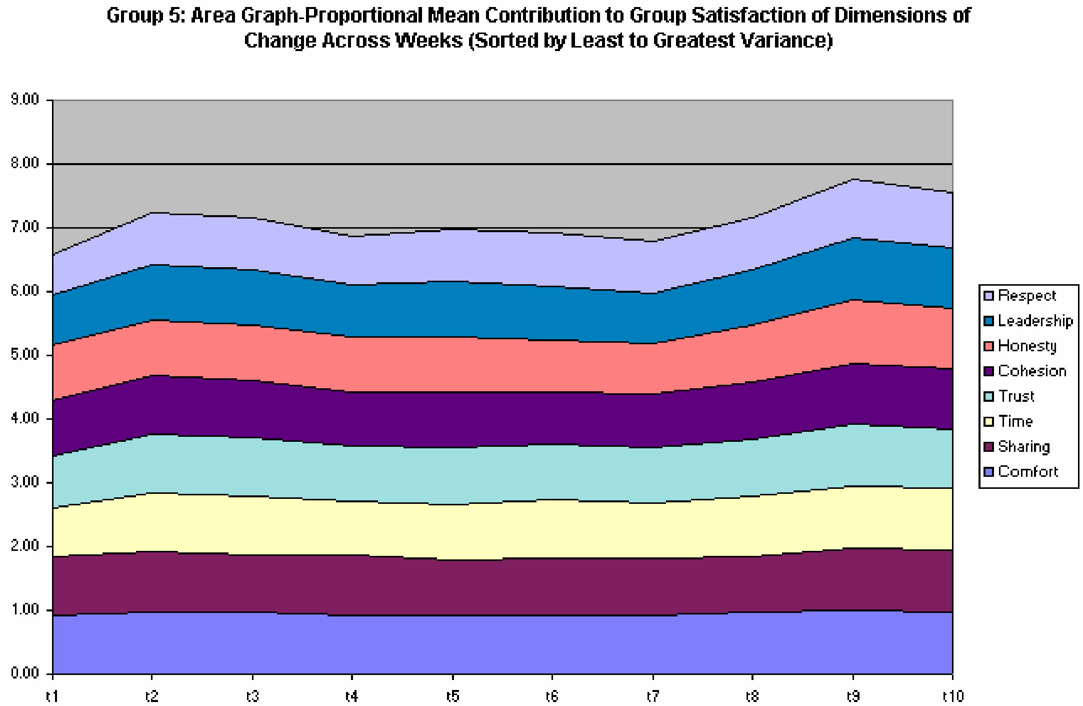


Figure 47. Group 5 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

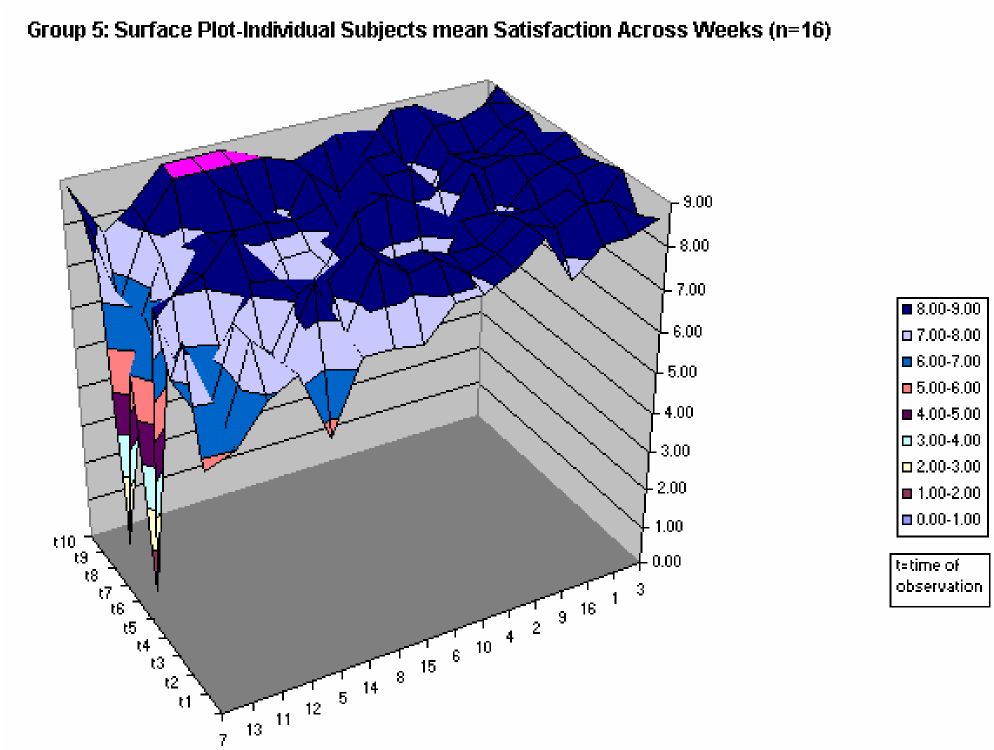


Figure 48. Group 5 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

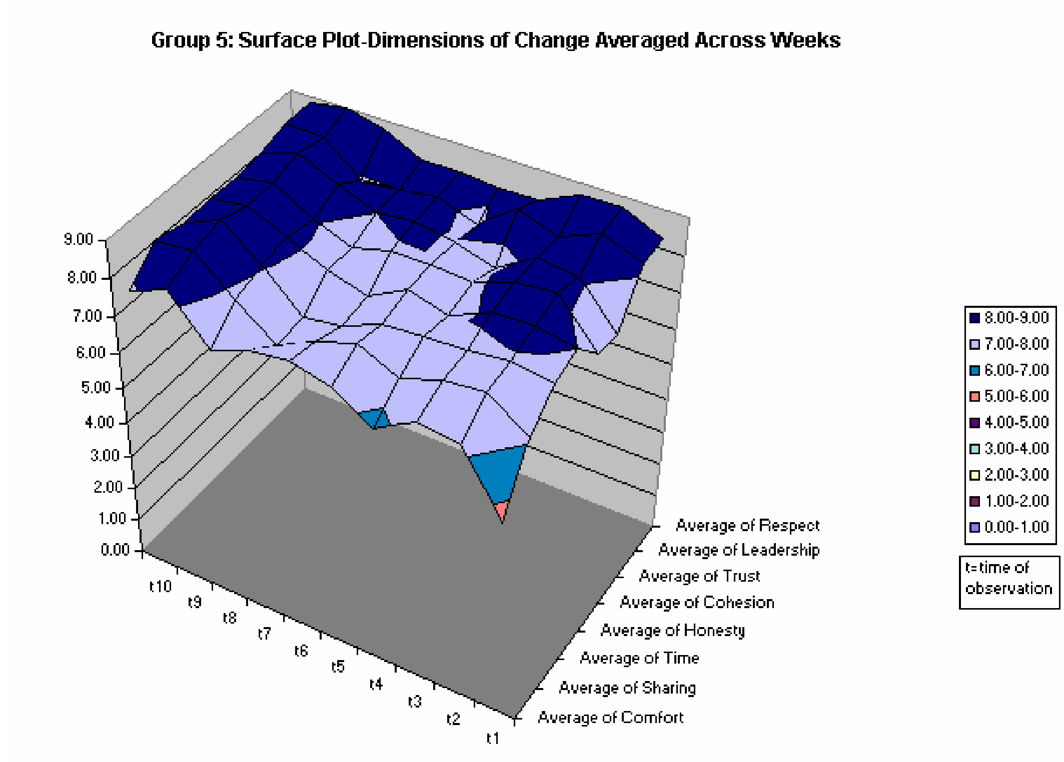


Figure 49. Group 5 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

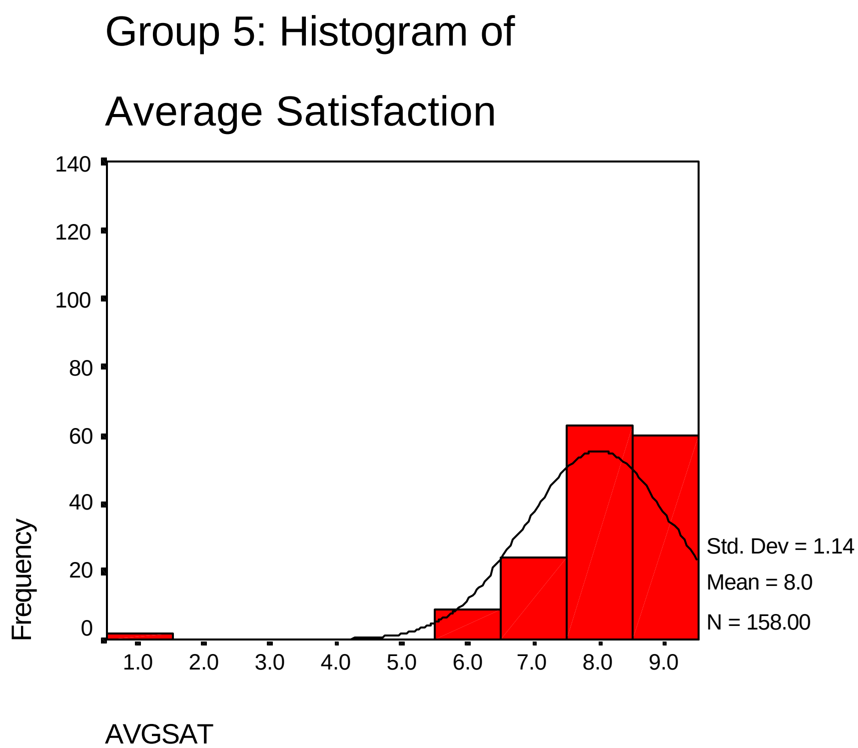


Figure 50. Group 5 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

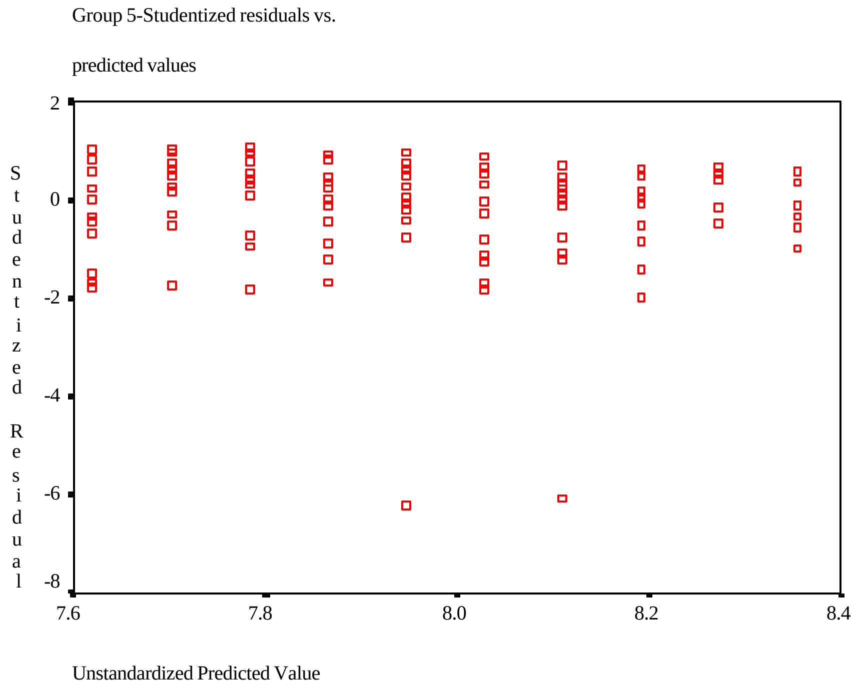


Figure 51. Group 5 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

Group 5-Studentized residuals vs.

order of observations

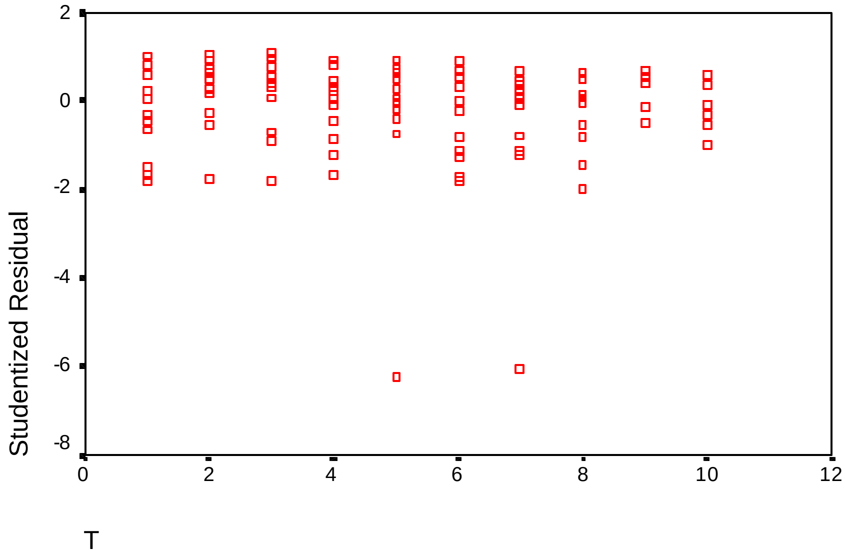


Figure 52. Group 5 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

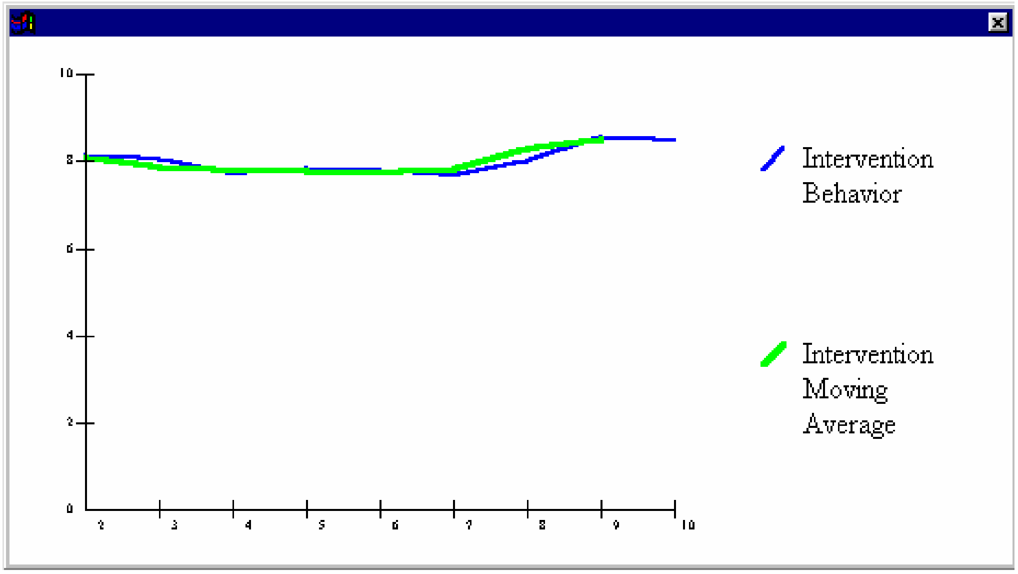


Figure 53. Group 5 (Singwin)-Moving average line: The intervention phase of group measurement.

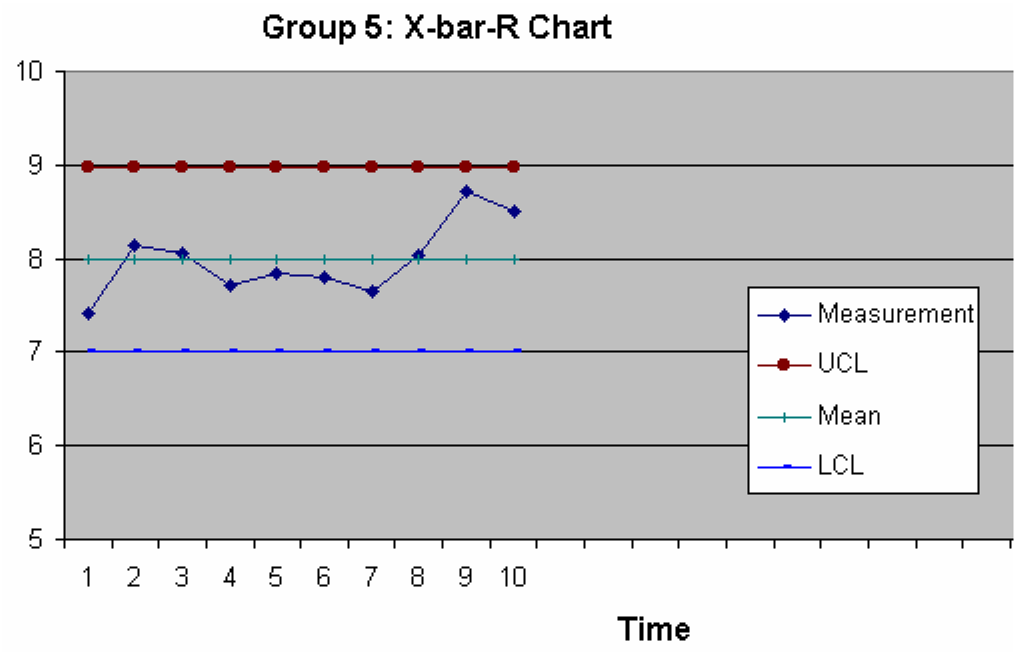


Figure 54. Group 5 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

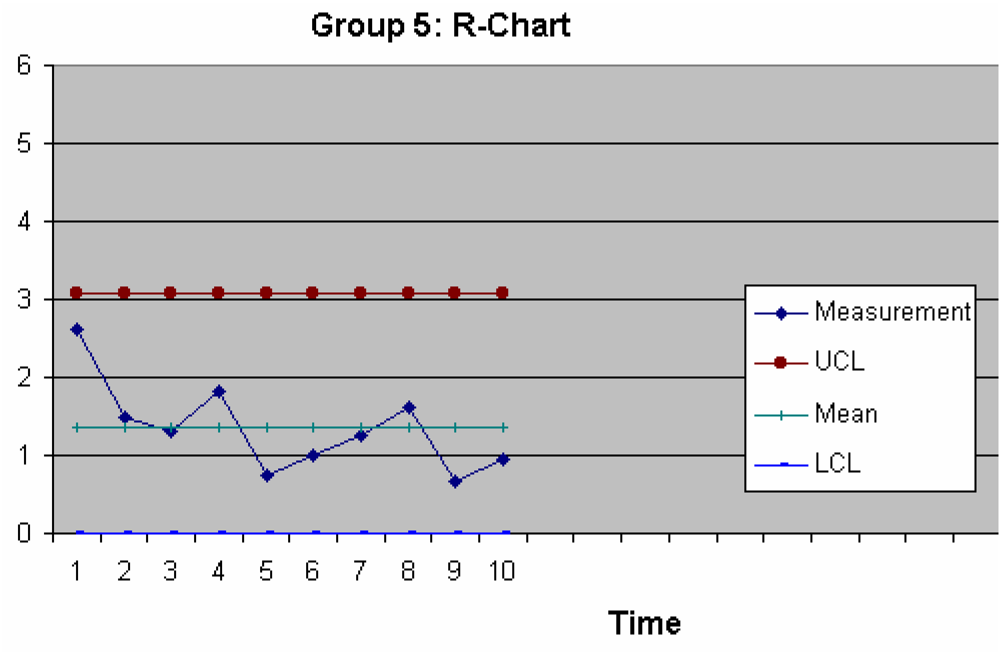


Figure 55. Group 5 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

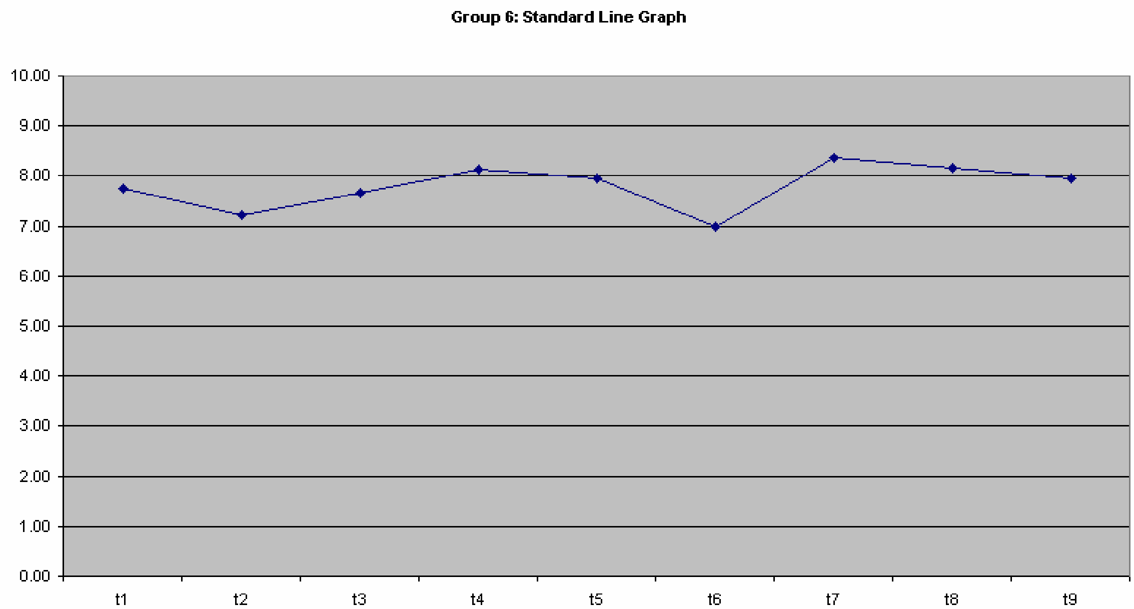


Figure 56. Group 6 (Excel)-Standard line graph: Average satisfaction across weeks.

Figure 57. Group 6 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

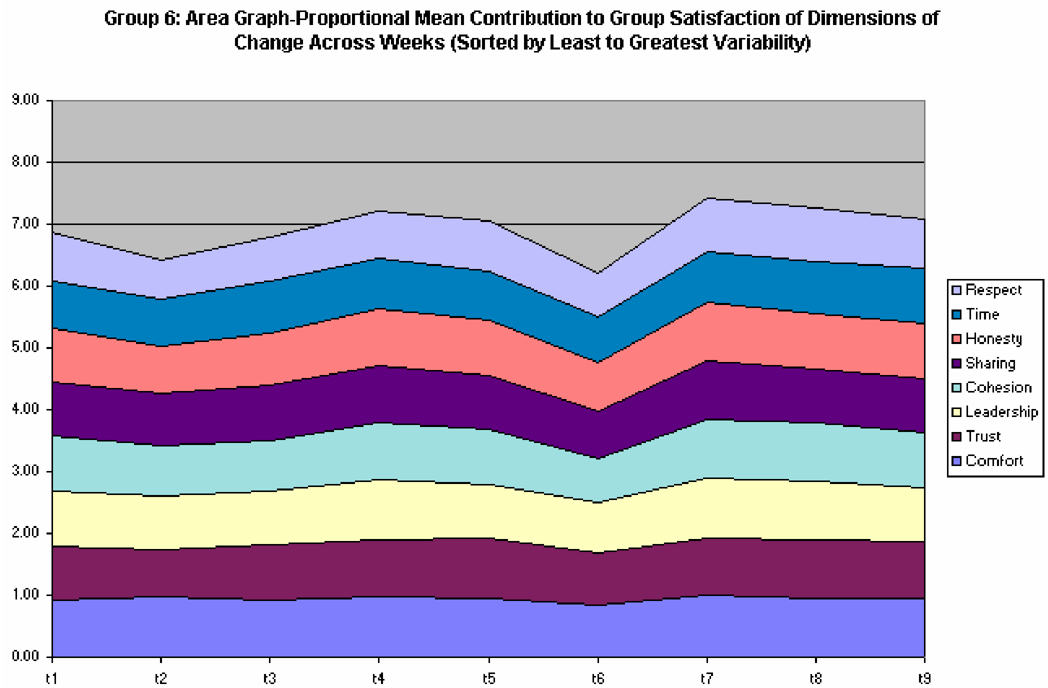


Figure 58. Group 6 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

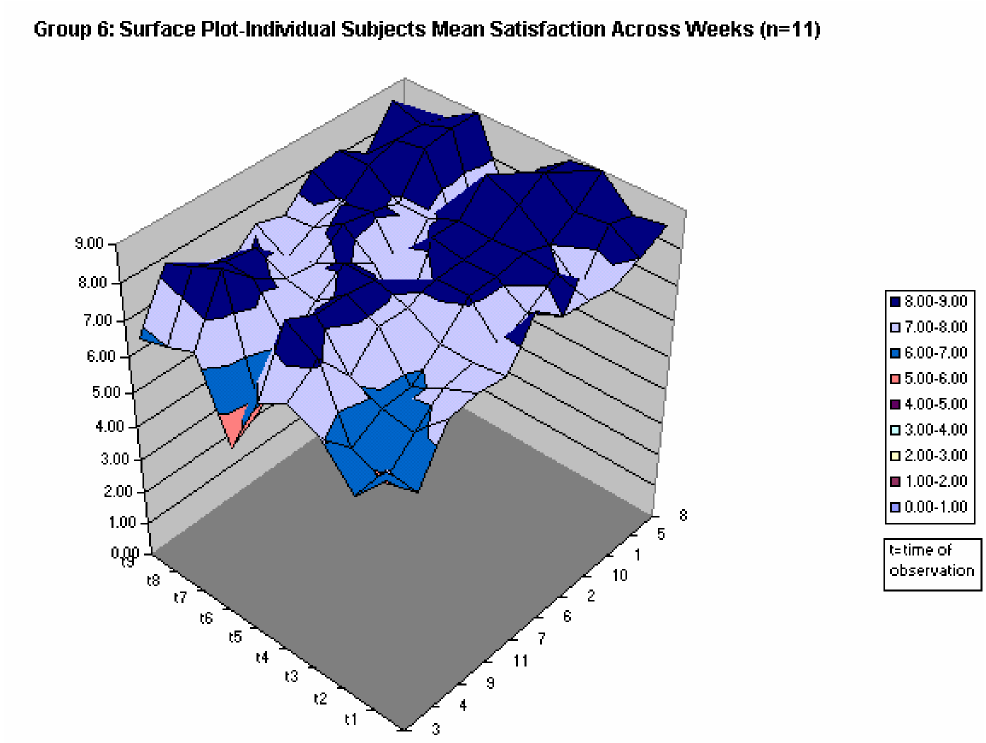


Figure 59. Group 6 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

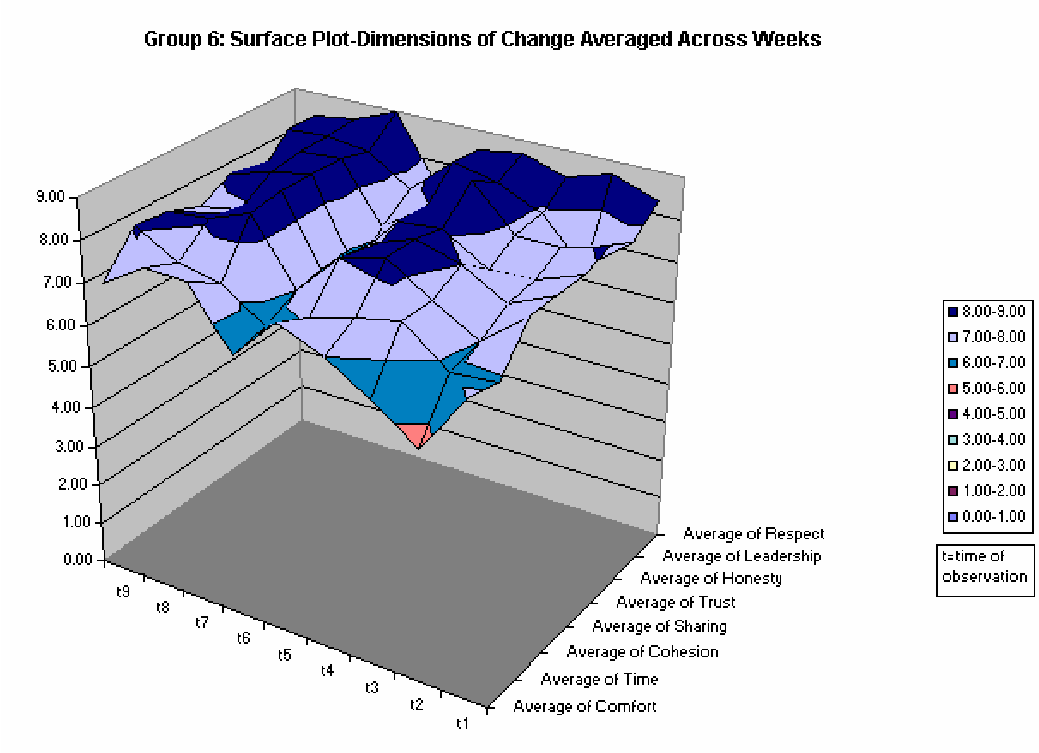


Figure 60. Group 6 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

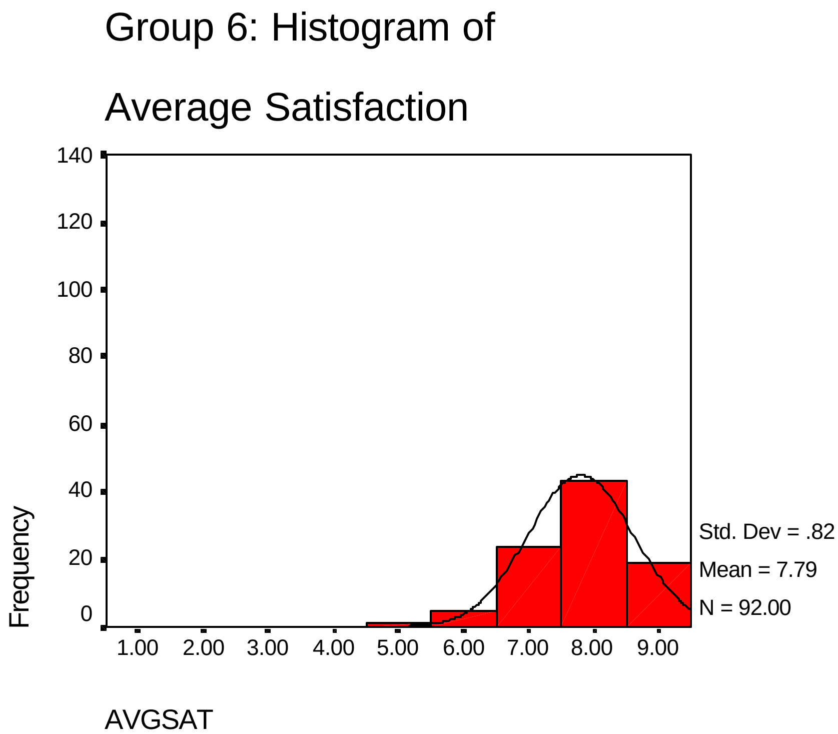


Figure 61. Group 6 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

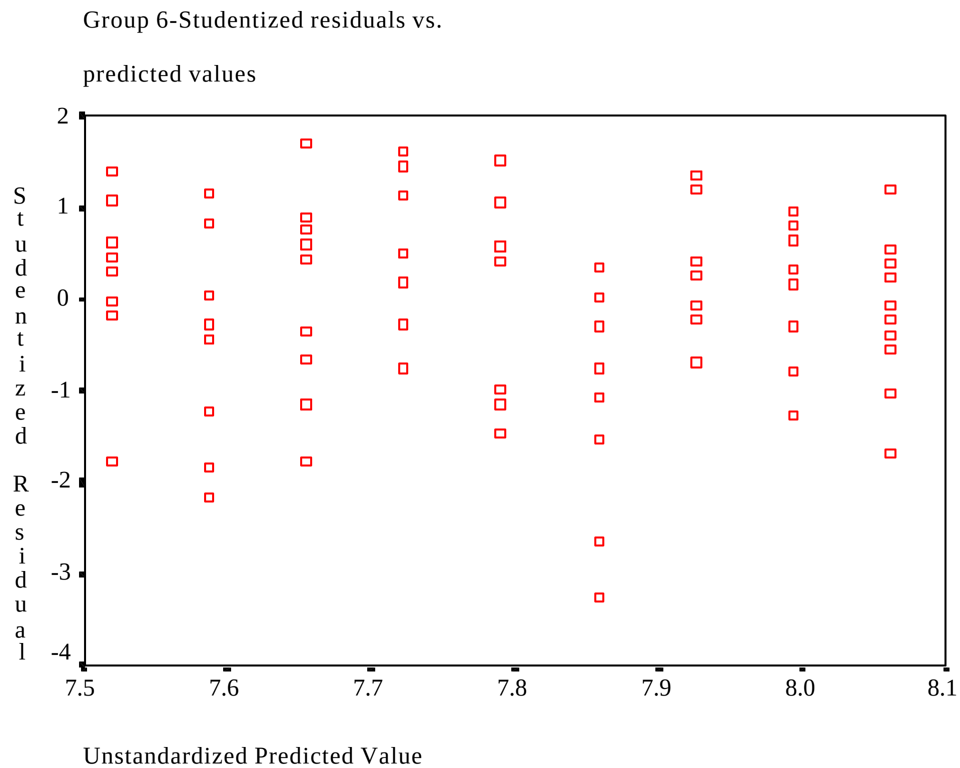


Figure 62. Group 6 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

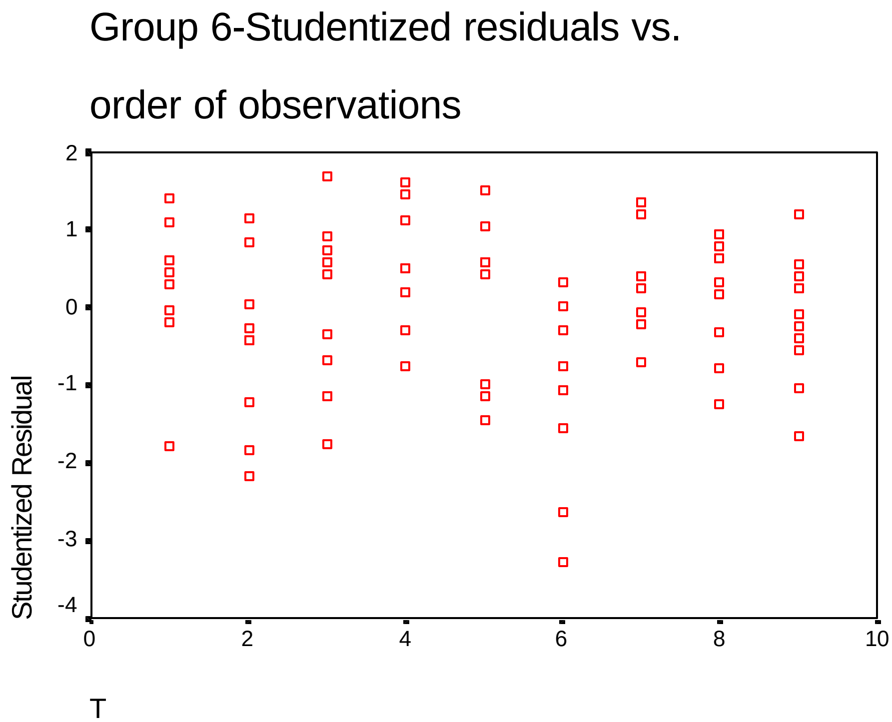


Figure 63. Group 6 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

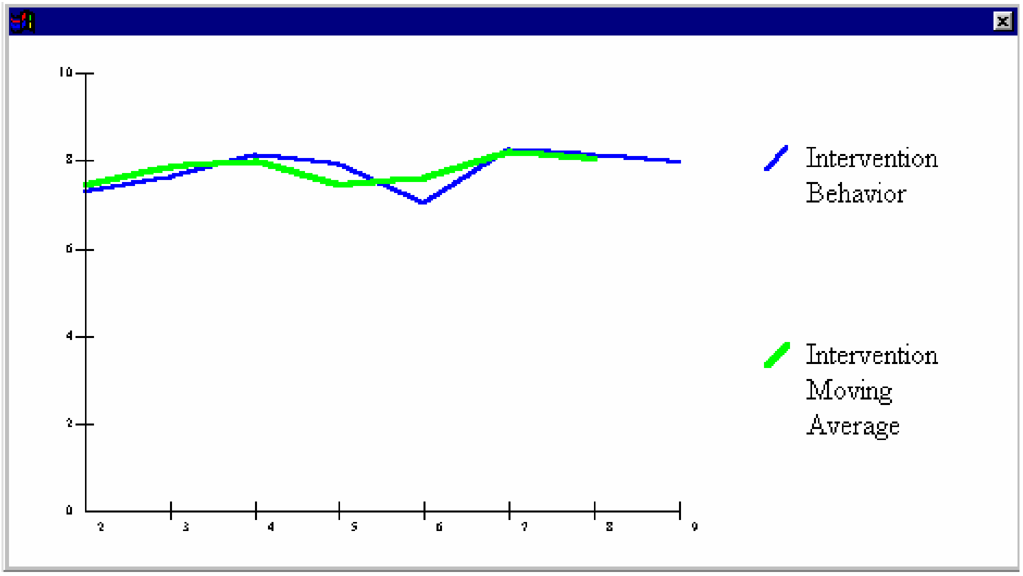


Figure 64. Group 6 (Singwin)-Moving average line: The intervention phase of group measurement.

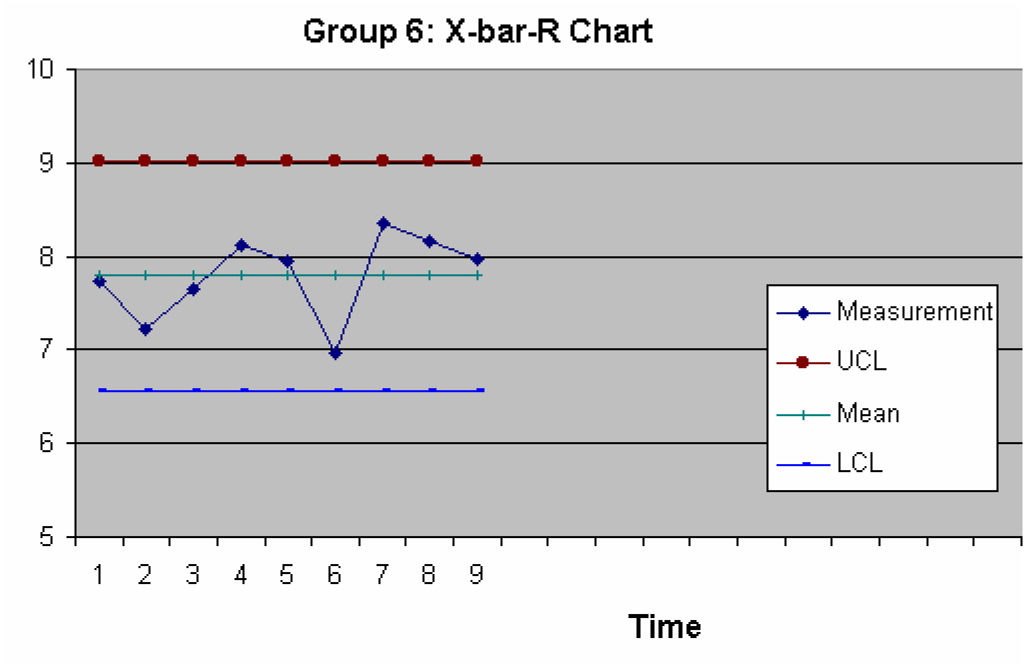


Figure 65. Group 6 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

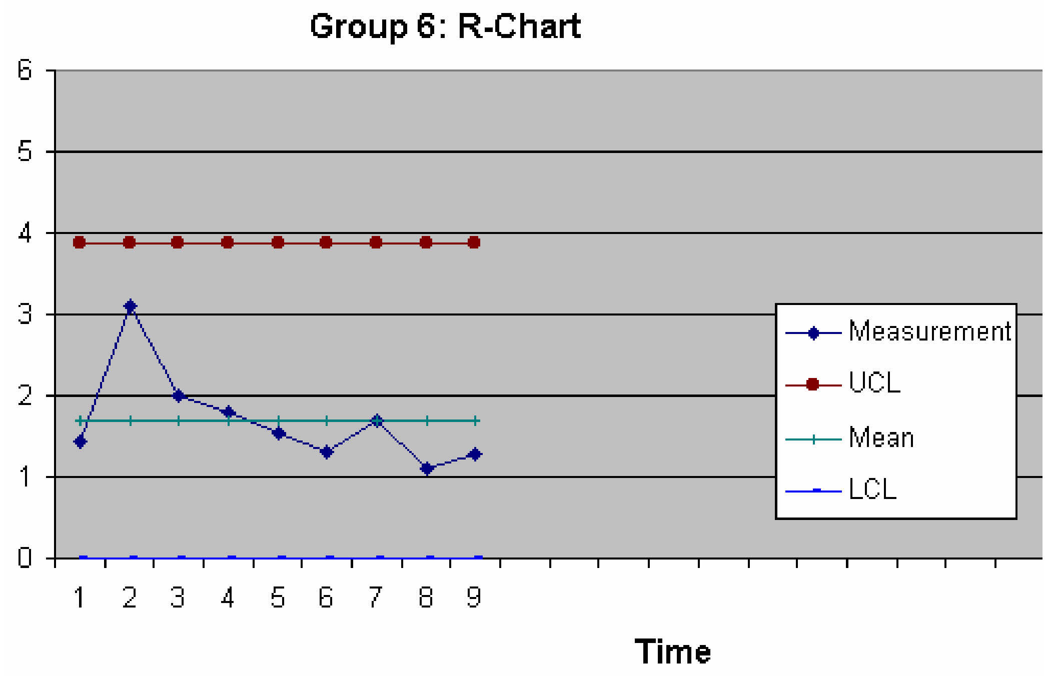


Figure 66. Group 6 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

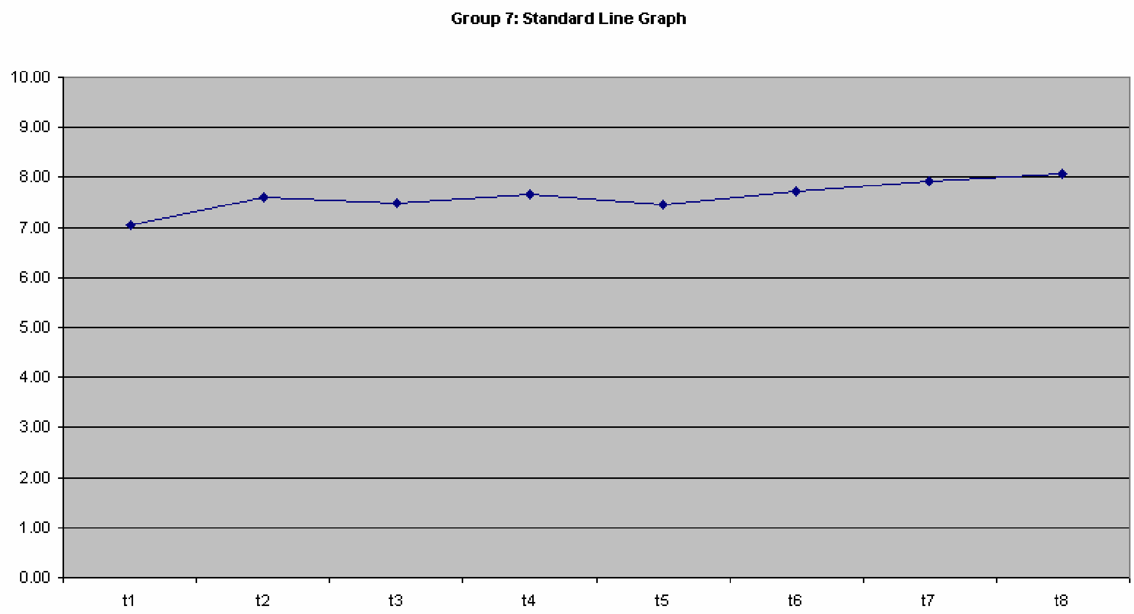


Figure 67. Group 7 (Excel)-Standard line graph: Average satisfaction across weeks.

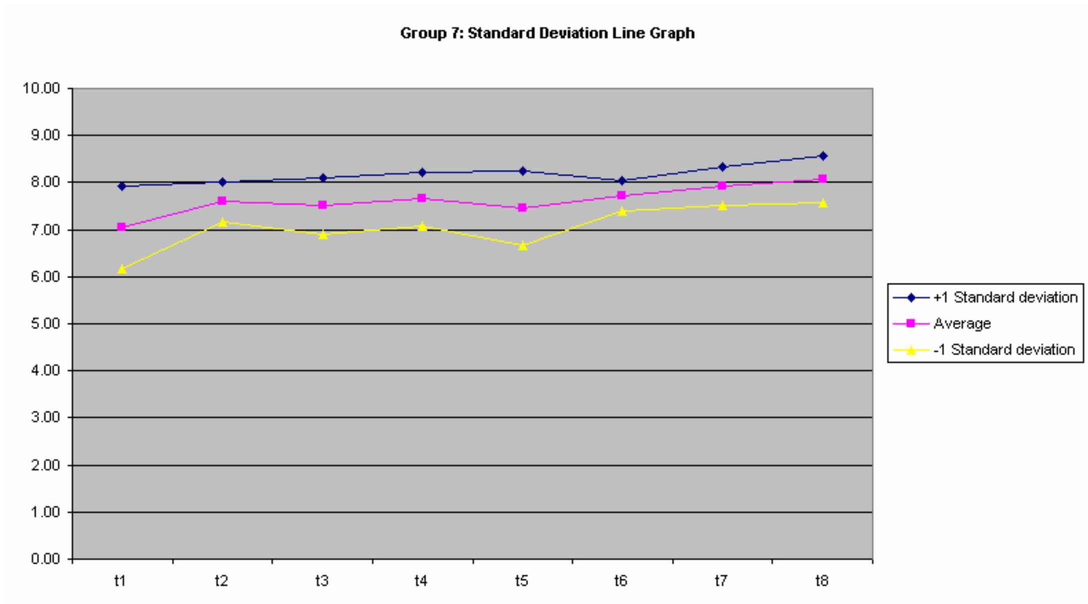
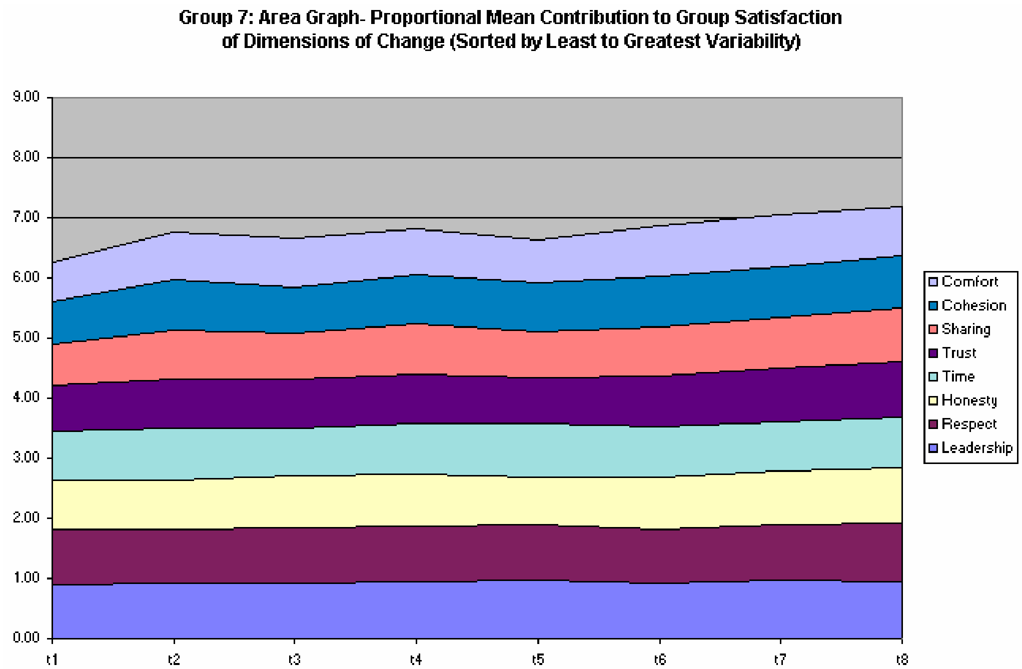


Figure 68. Group 7 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.



<u>Figure 69.</u> Group 7 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

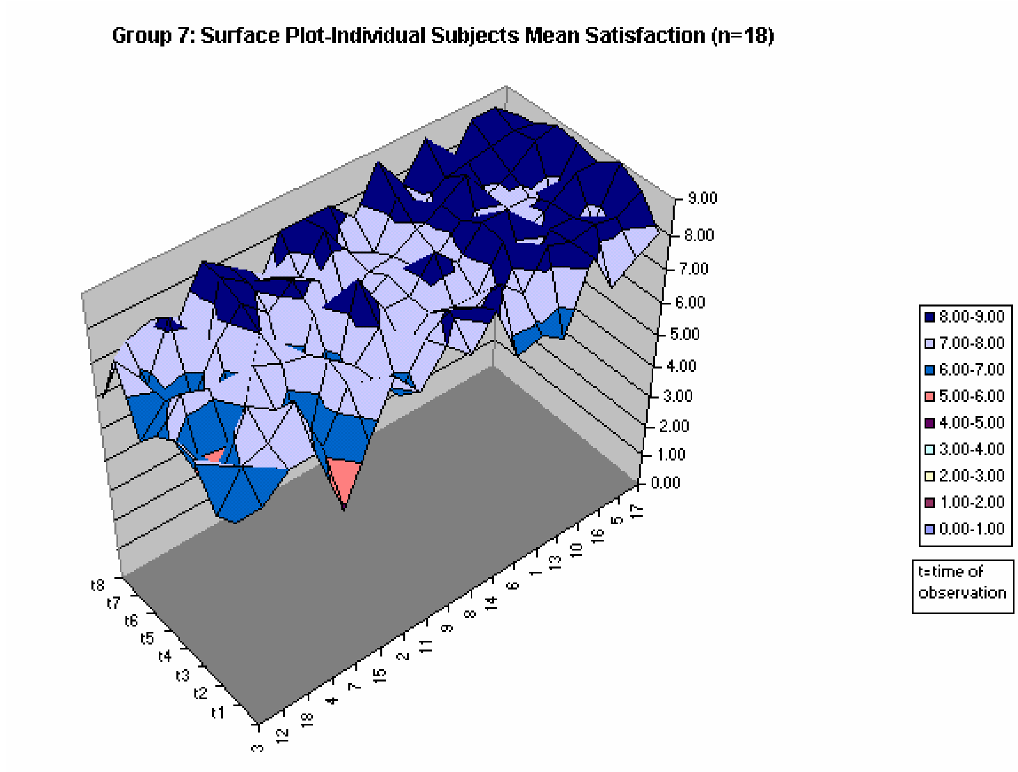


Figure 70. Group 7 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

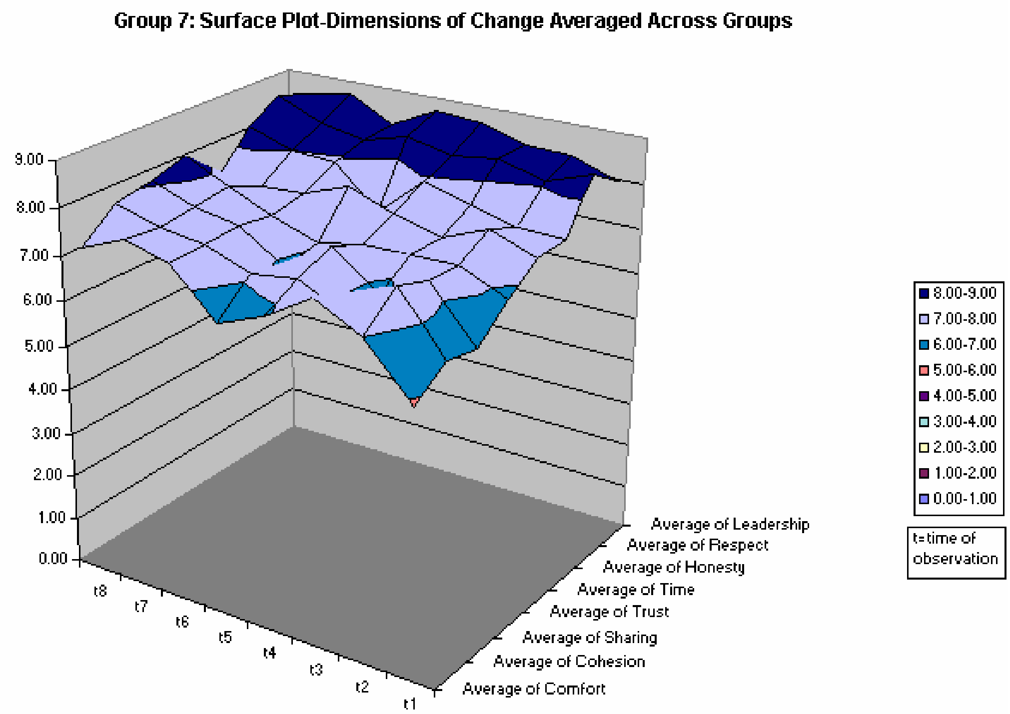


Figure 71. Group 7 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

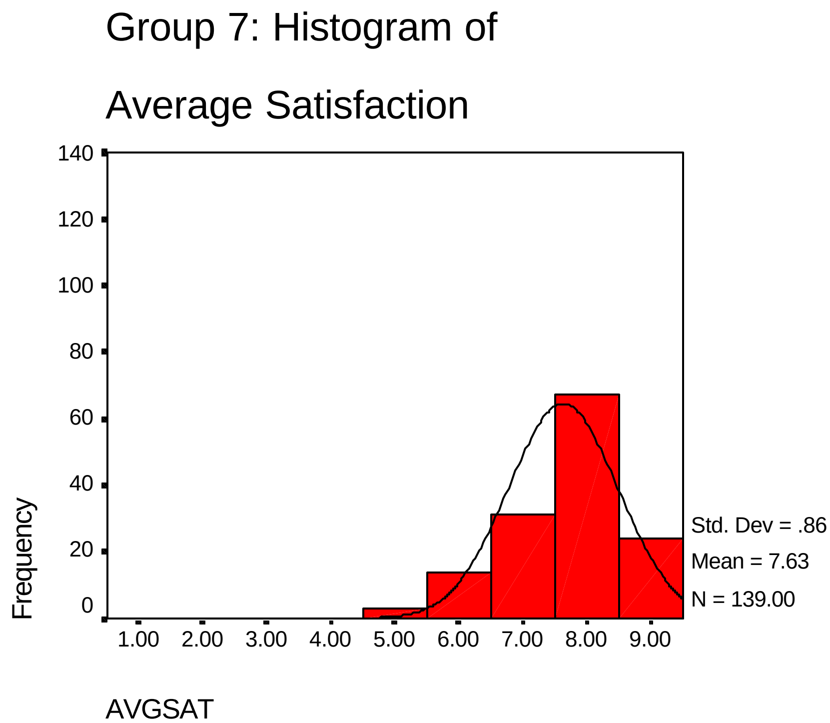


Figure 72. Group 7 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

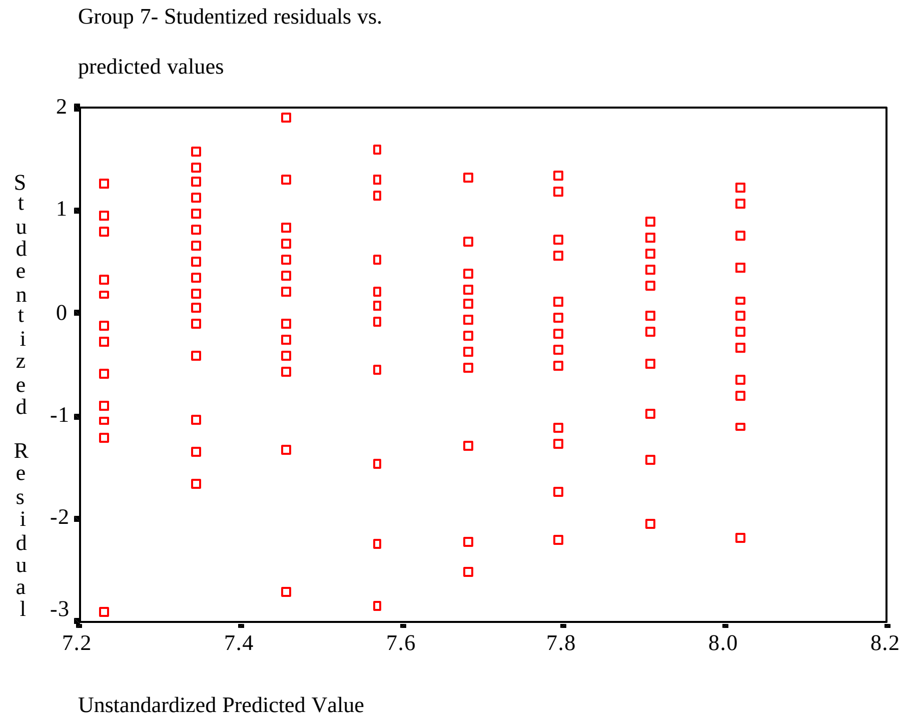


Figure 73. Group 7 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

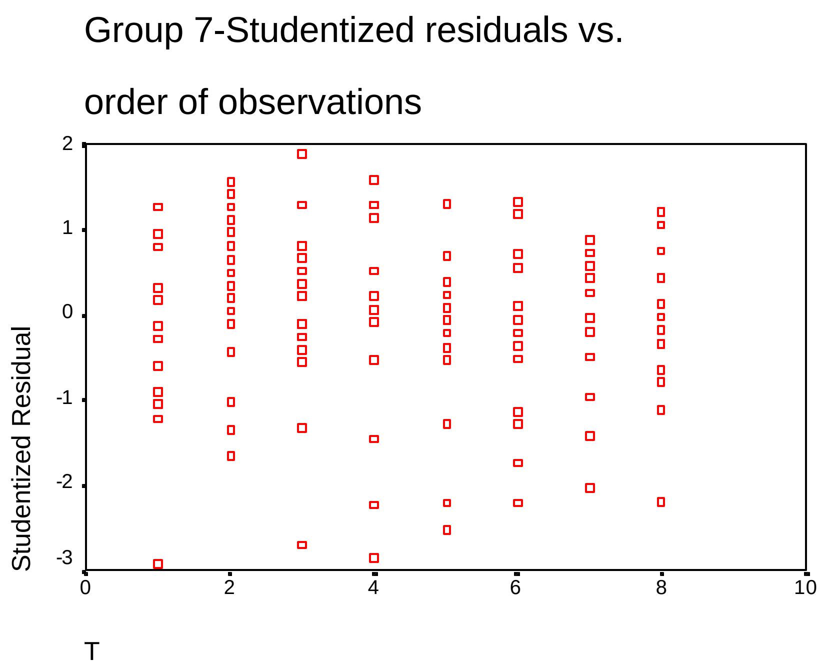


Figure 74. Group 7 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

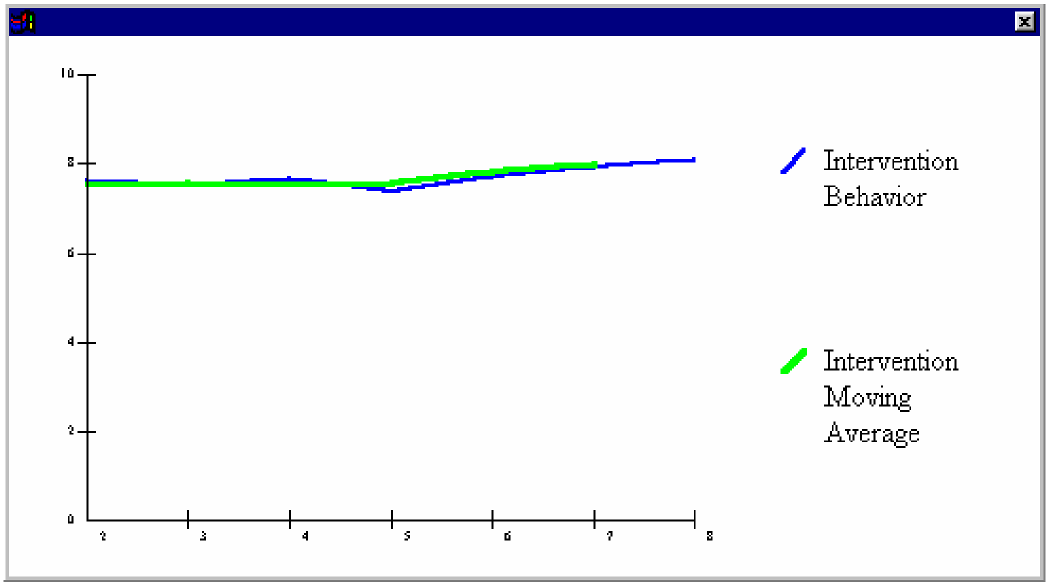


Figure 75. Group 7 (Singwin)-Moving average line: The intervention phase of group measurement.

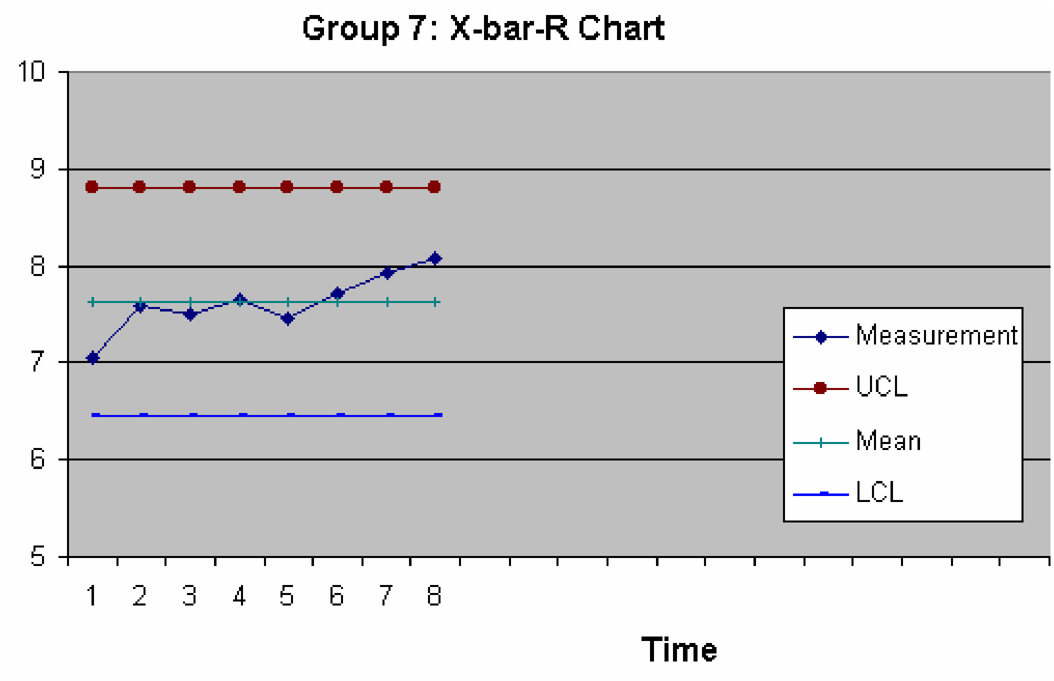


Figure 76. Group 7 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

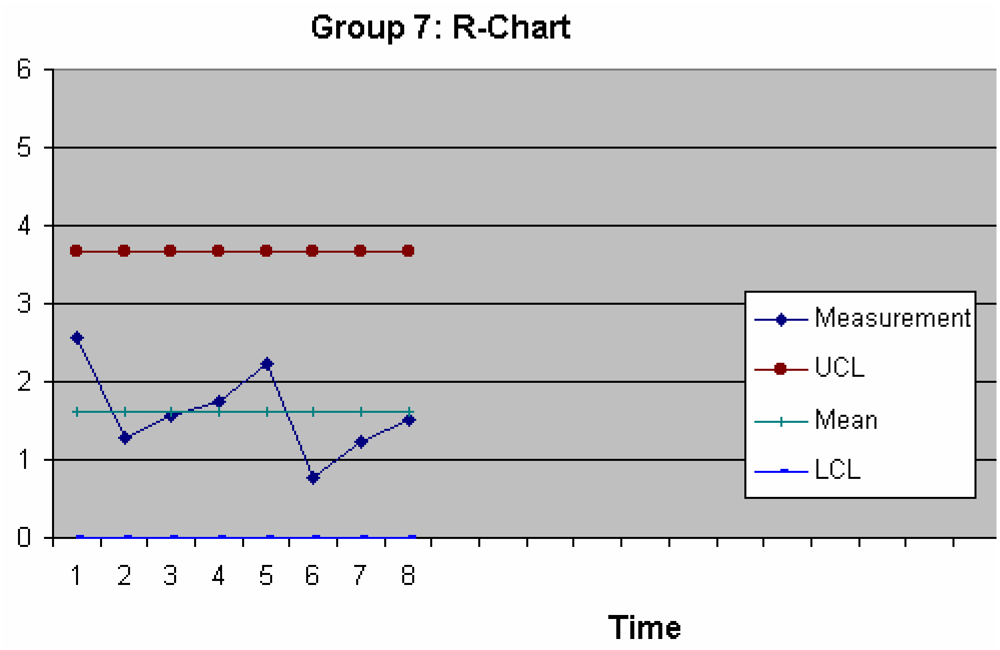


Figure 77. Group 7 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

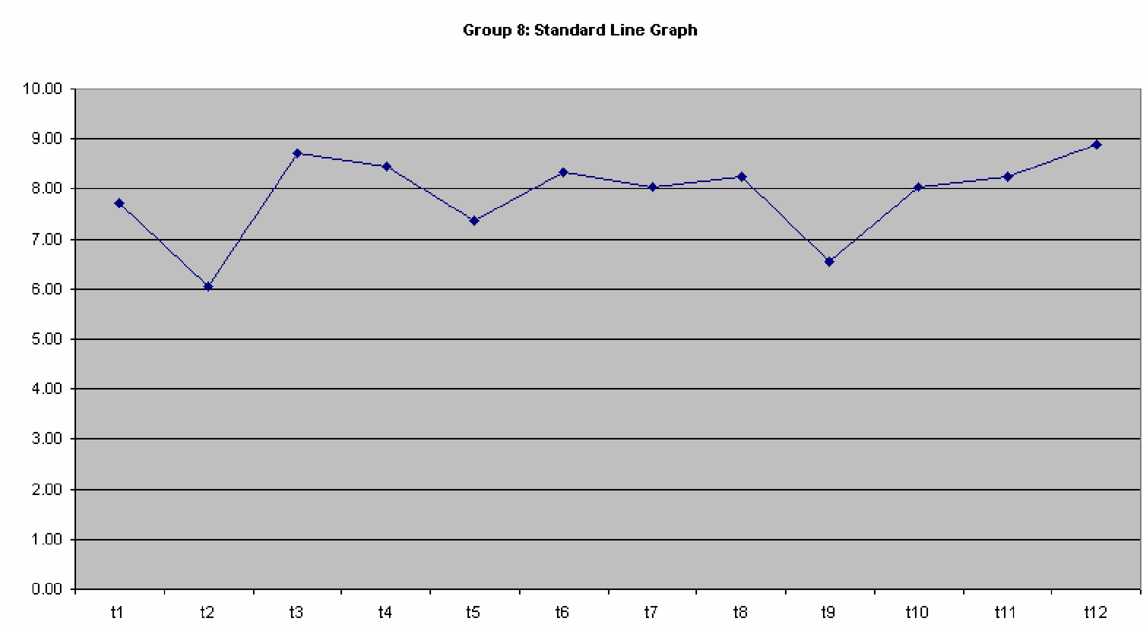


Figure 78. Group 8 (Excel)-Standard line graph: Average satisfaction across weeks.

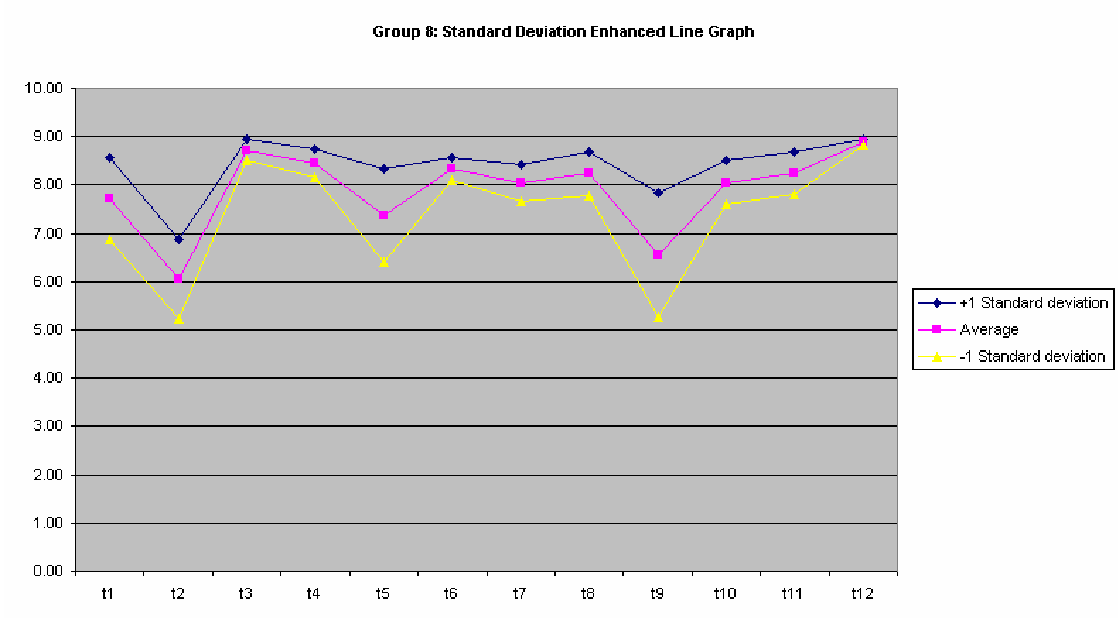


Figure 79. Group 8 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

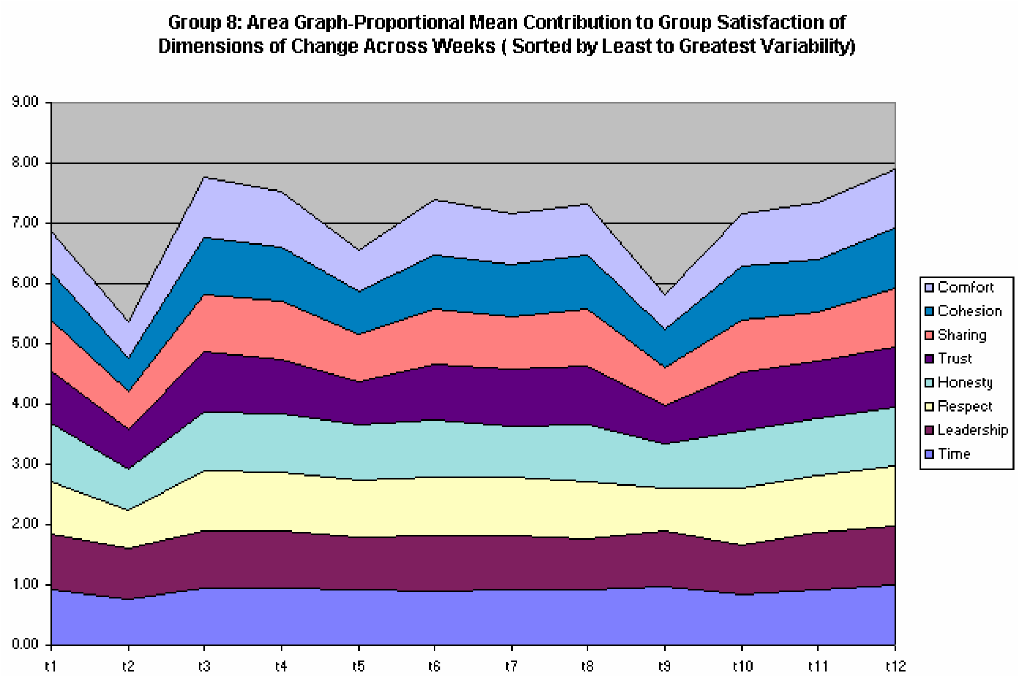


Figure 80. Group 8 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

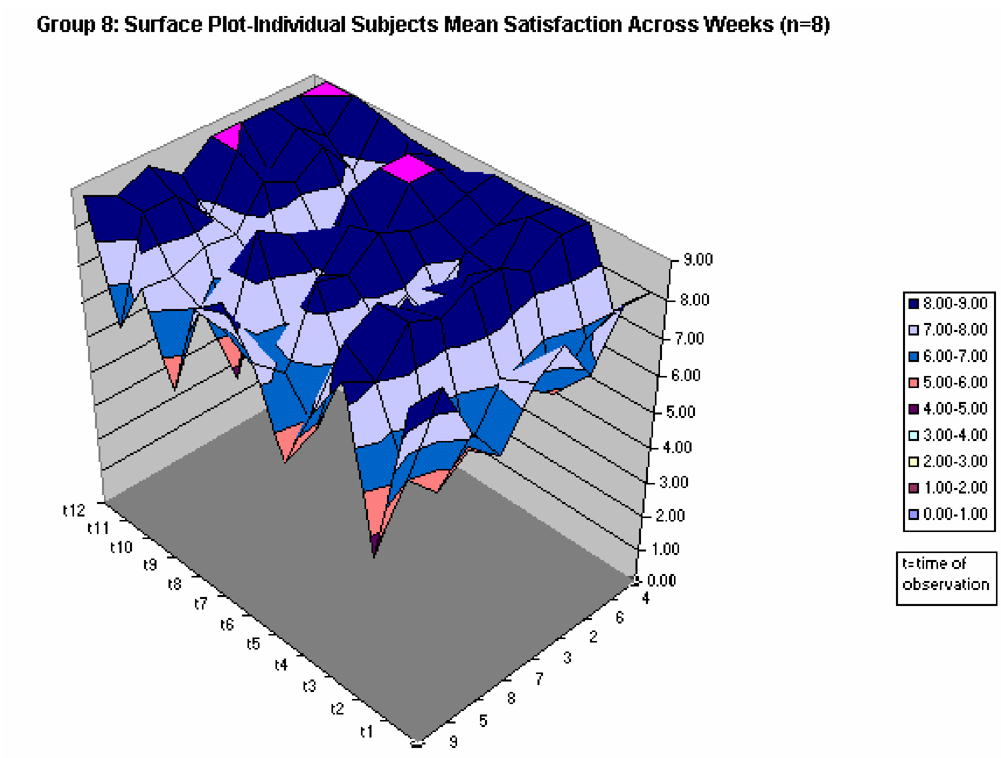


Figure 81. Group 8 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

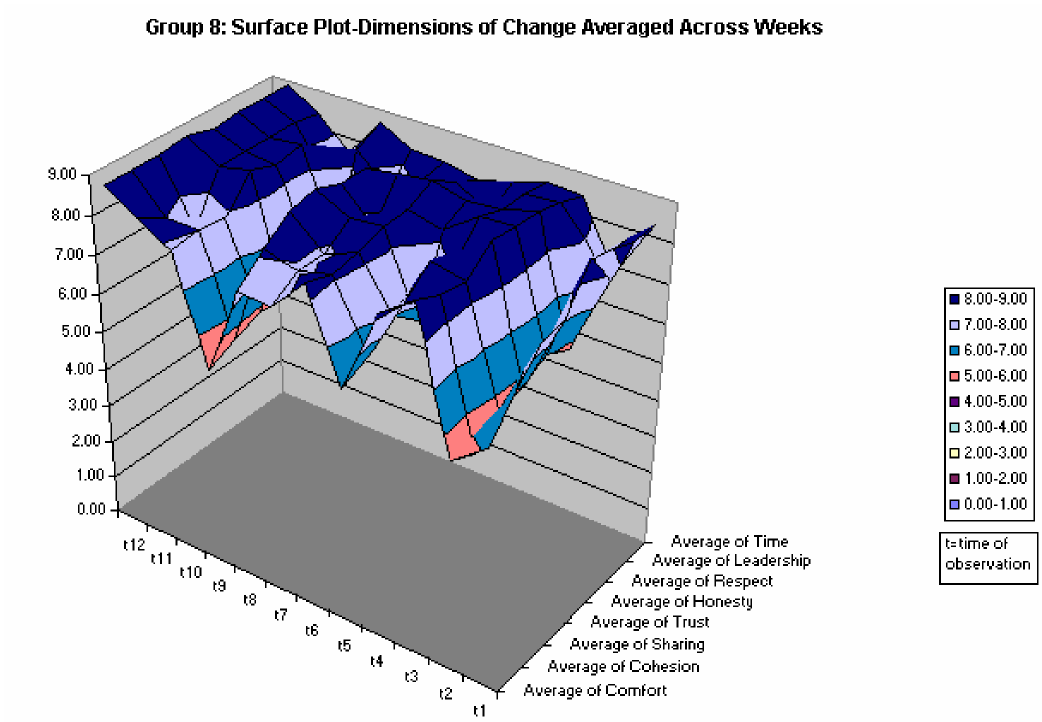


Figure 82. Group 8 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

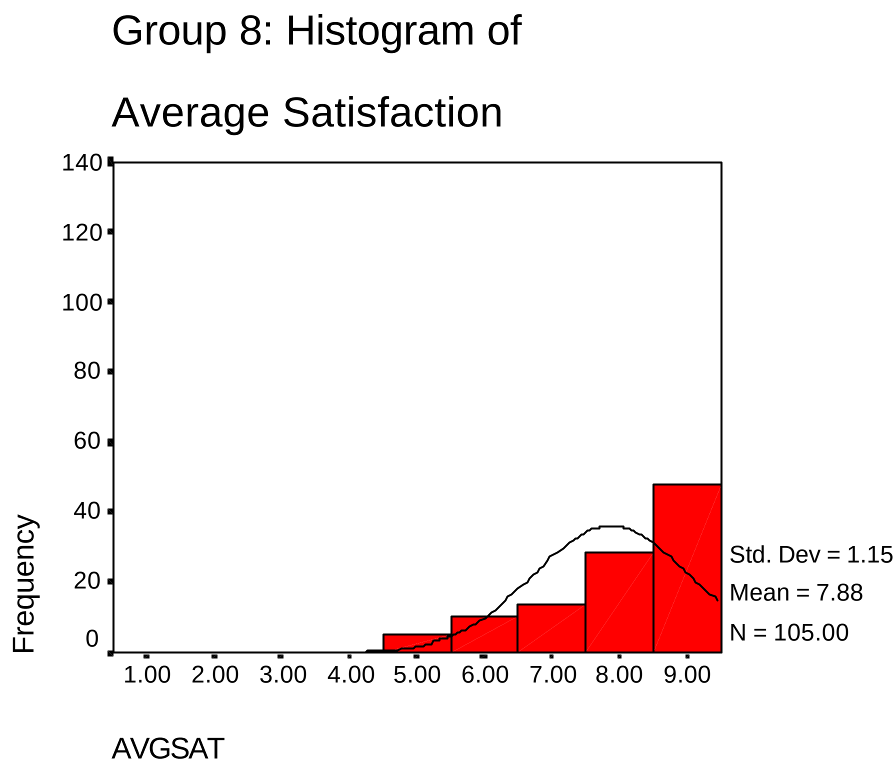


Figure 83. Group 8 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

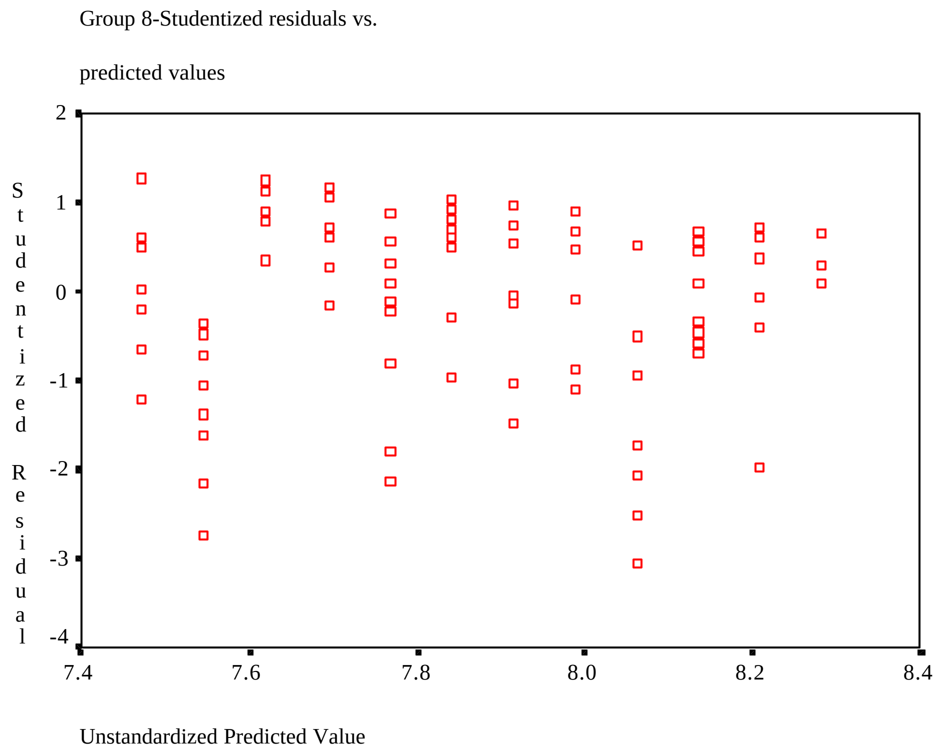


Figure 84. Group 8 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

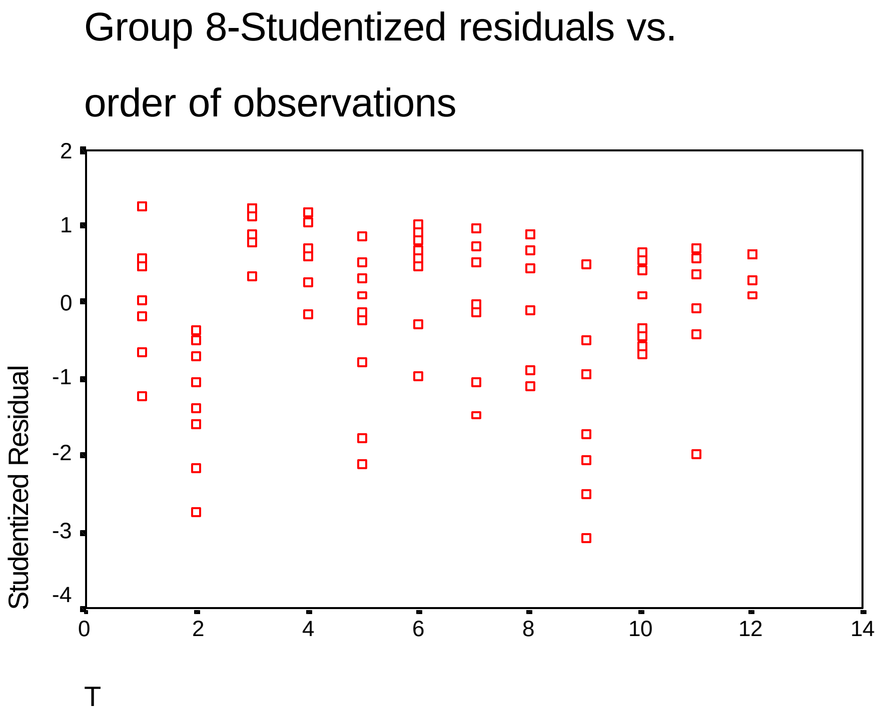


Figure 85. Group 8 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

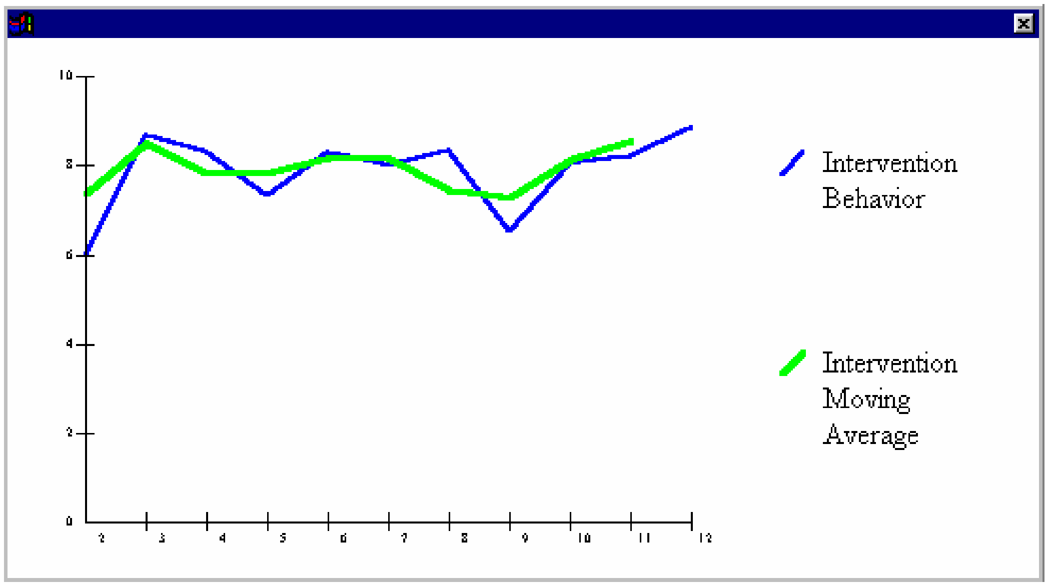


Figure 86. Group 8 (Singwin)-Moving average line: The intervention phase of group measurement.

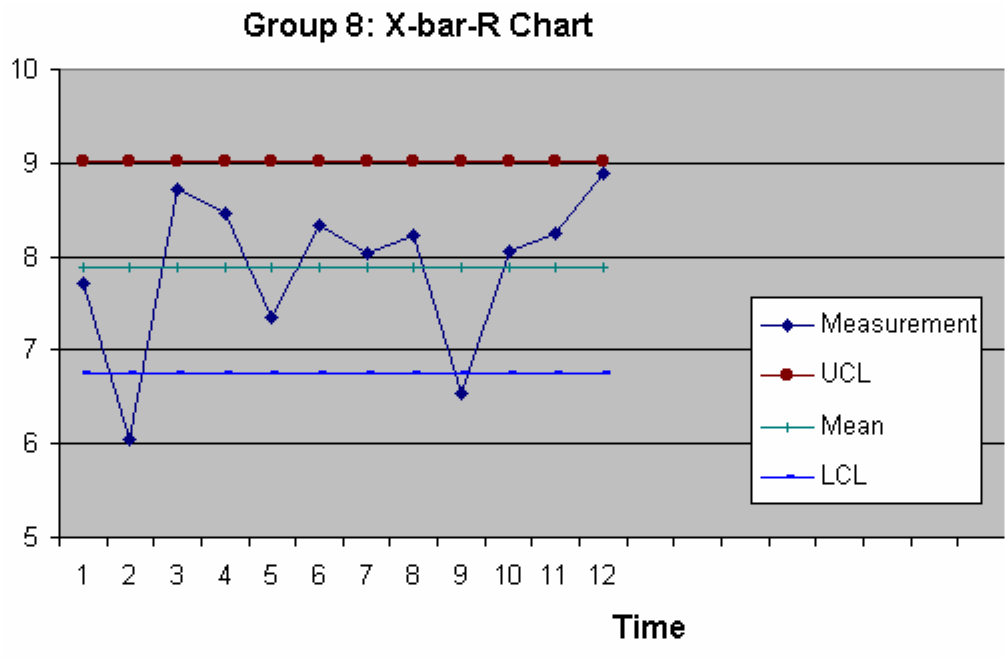


Figure 87. Group 8 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

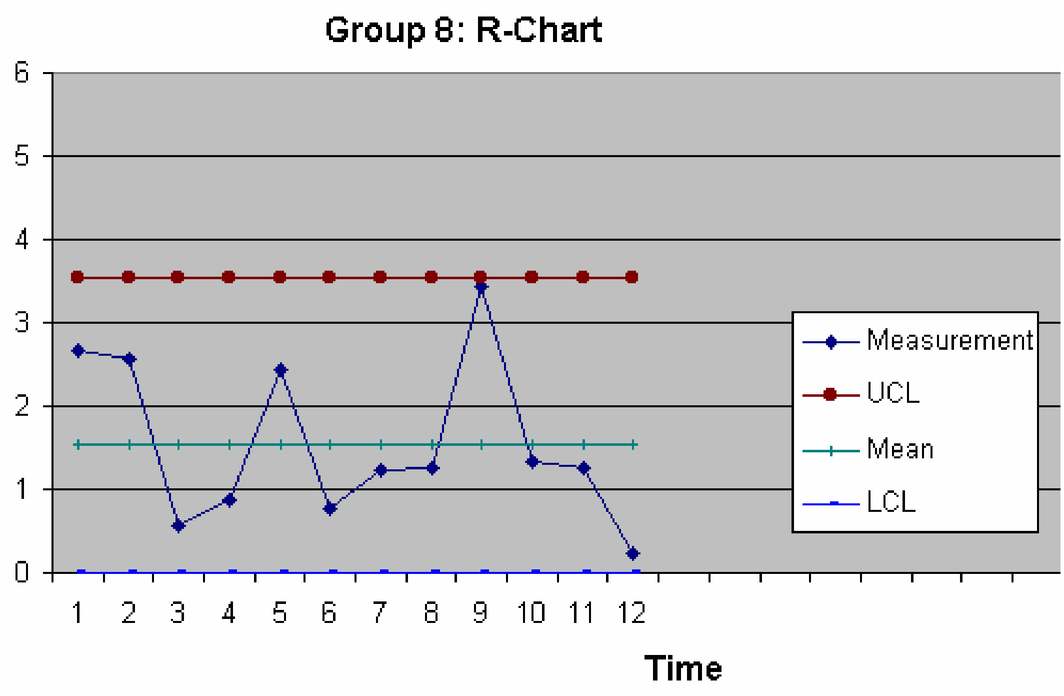


Figure 88. Group 8 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

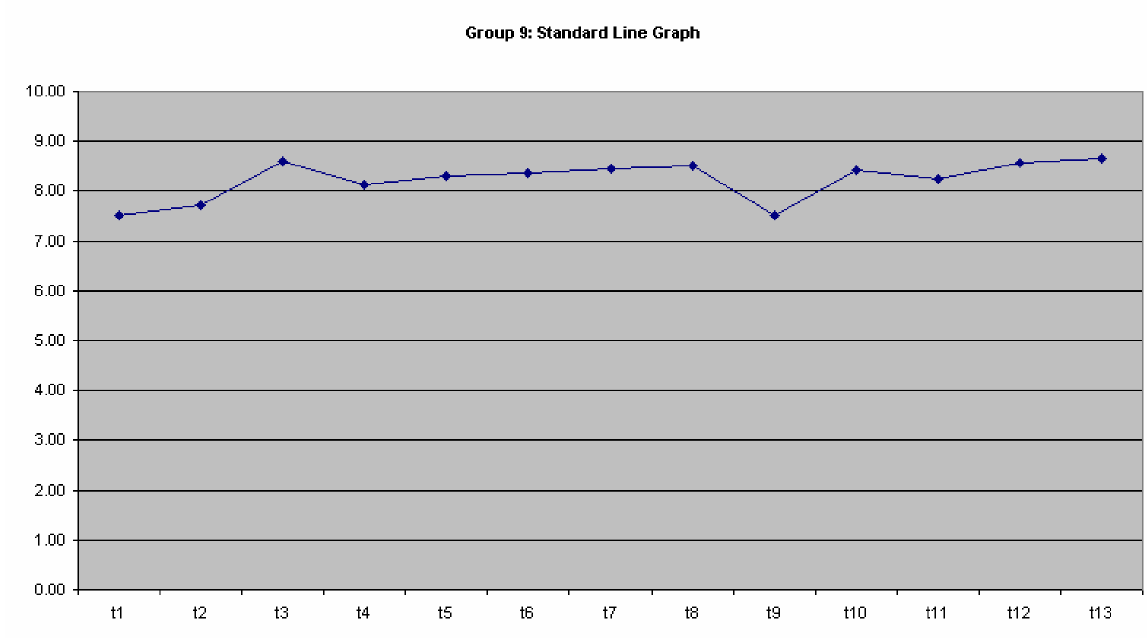


Figure 89. Group 9 (Excel)-Standard line graph: Average satisfaction across weeks.

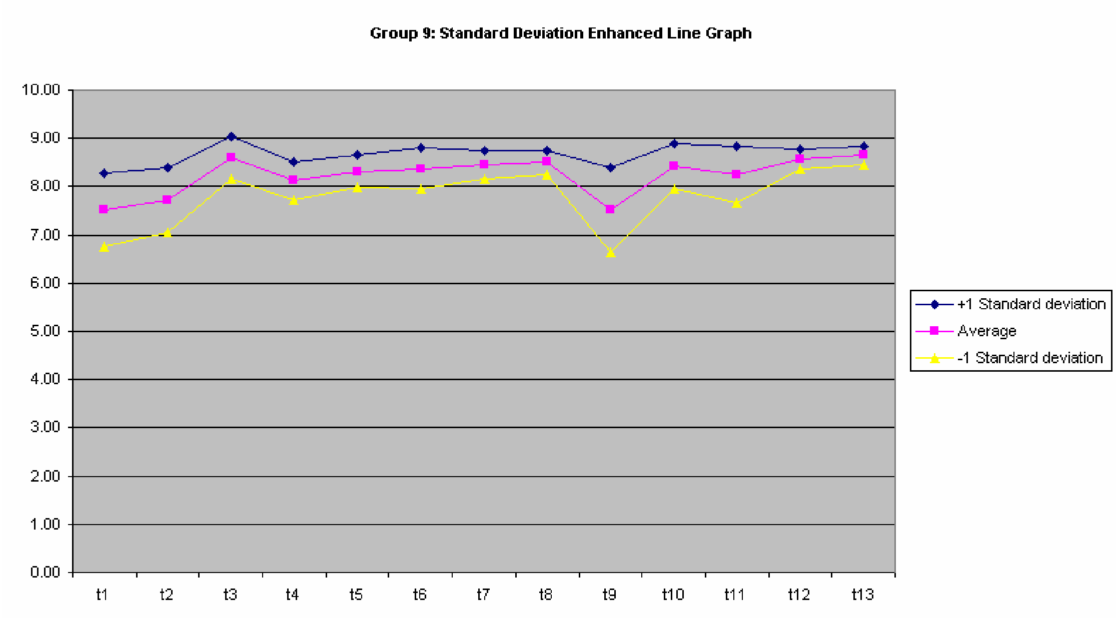


Figure 90. Group 9 (Excel)-Standard deviation enhanced line graph (SDELG):

Concordance and variation of group satisfaction across weeks.

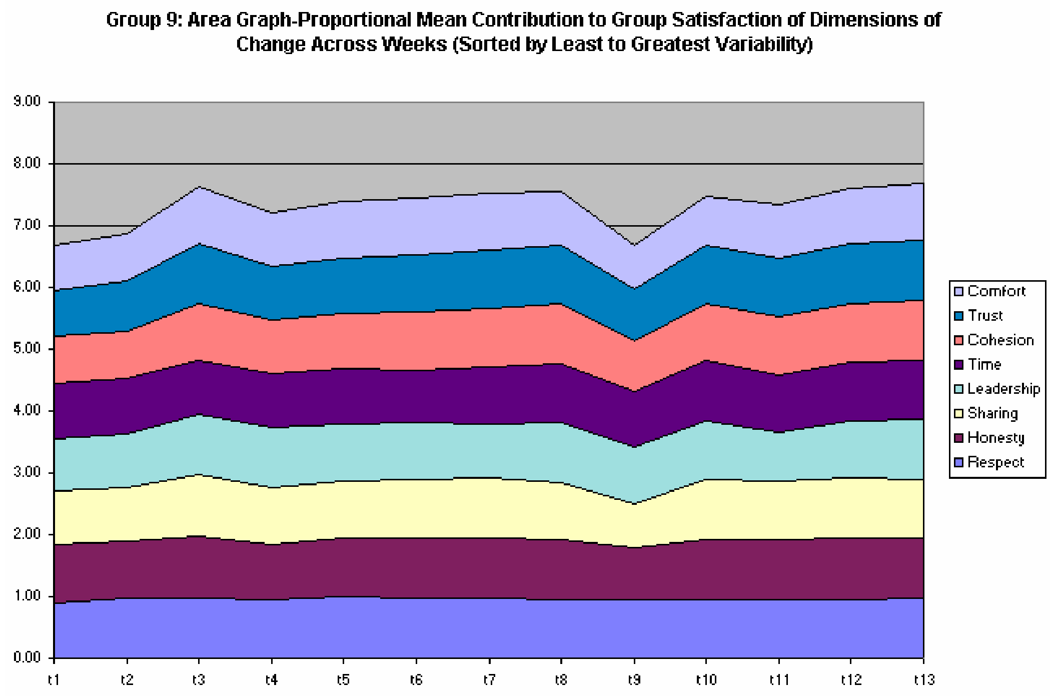


Figure 91. Group 9 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

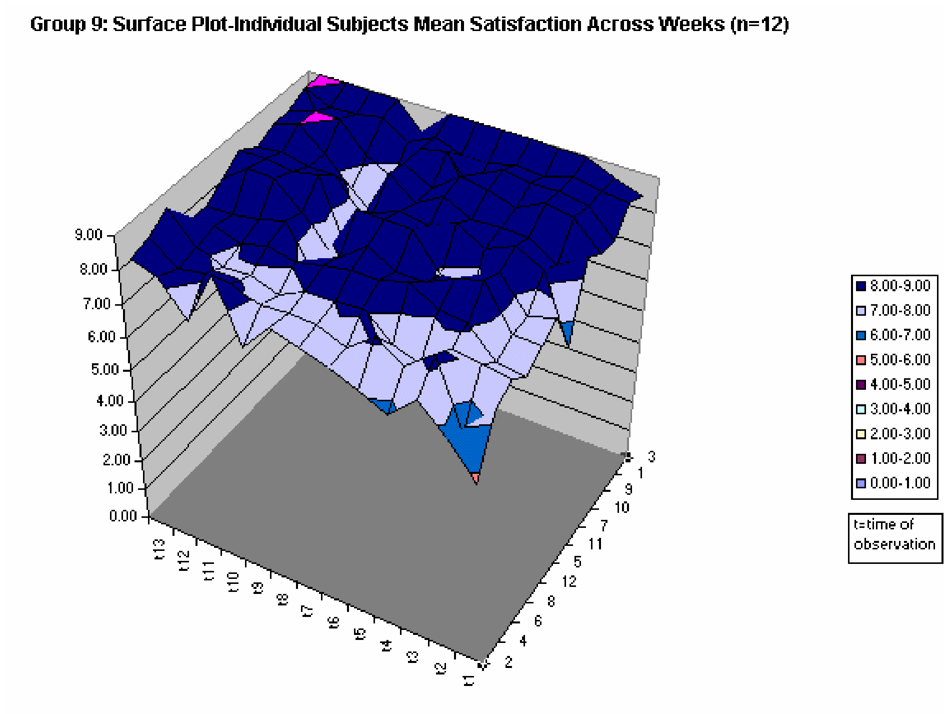


Figure 92. Group 9 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

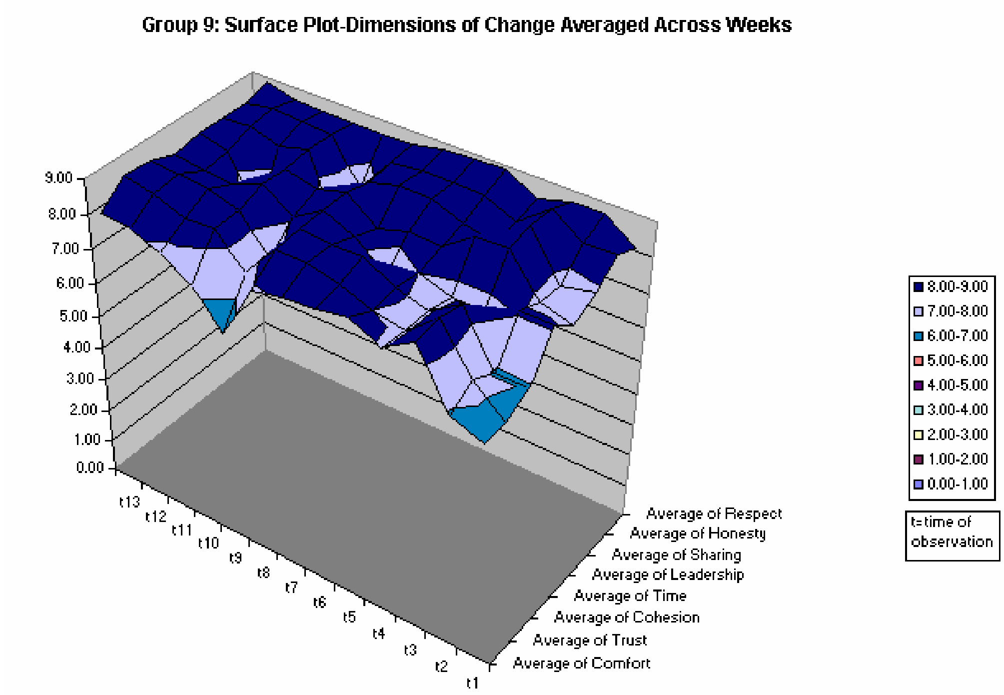


Figure 93. Group 9 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

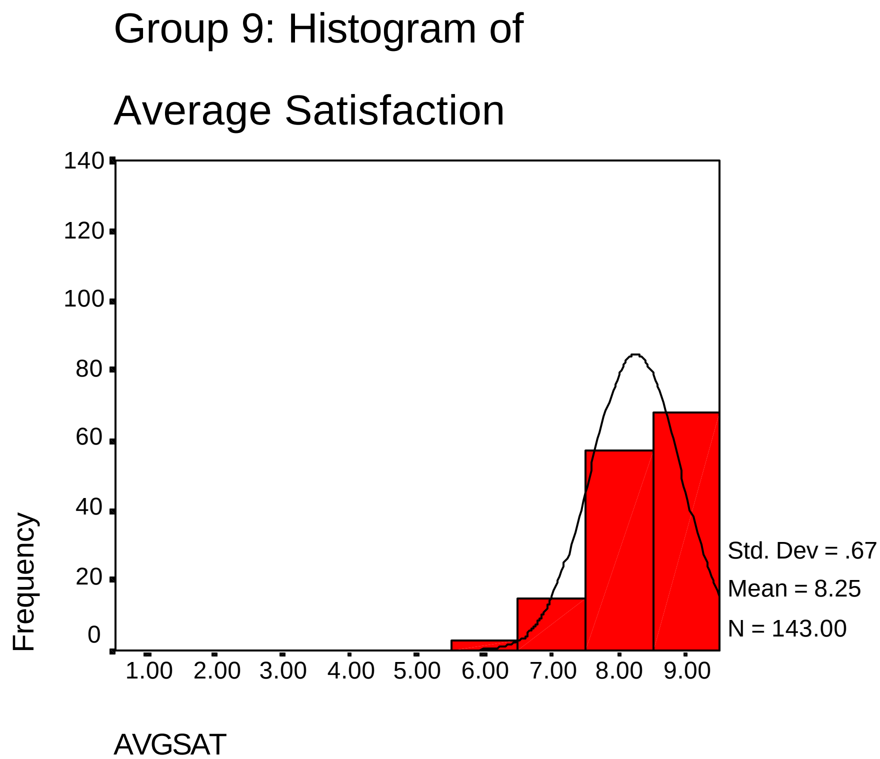


Figure 94. Group 9 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

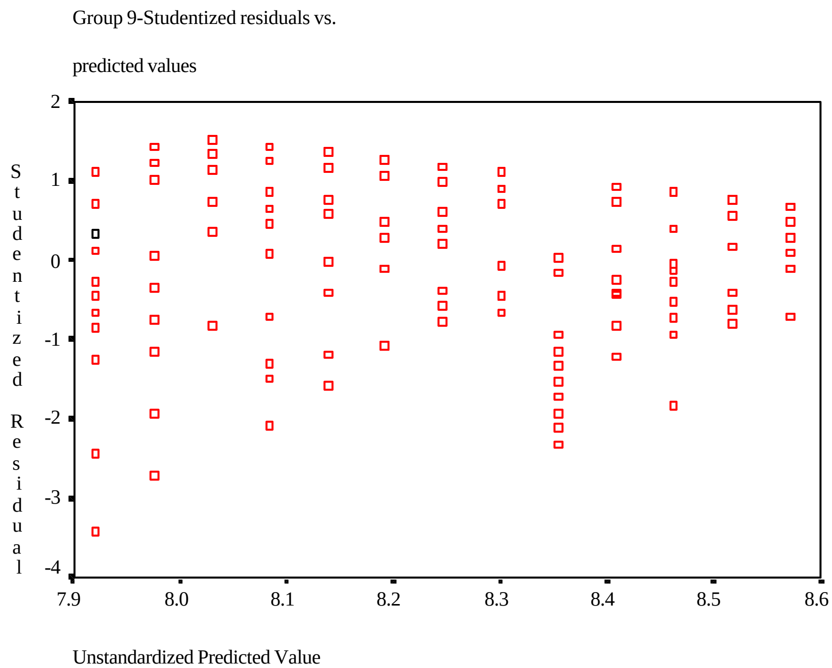


Figure 95. Group 9 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

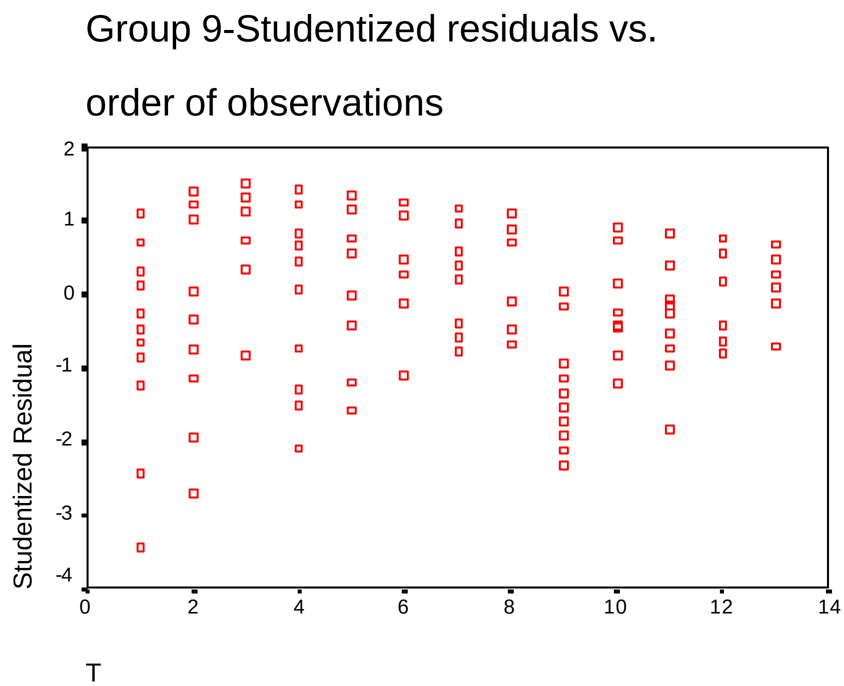


Figure 96. Group 9 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

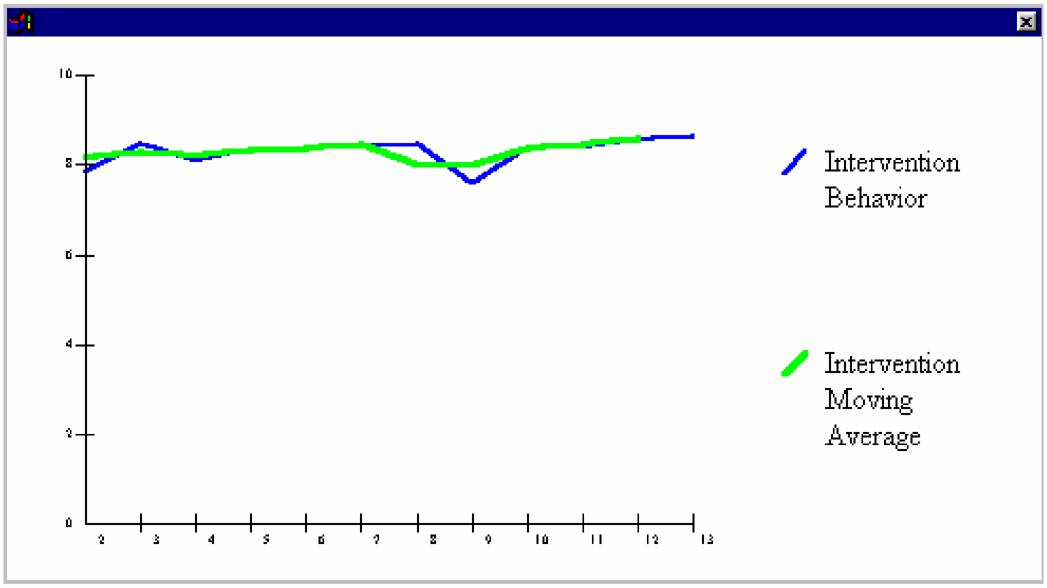


Figure 97. Group 9 (Singwin)-Moving average line: The intervention phase of group measurement.

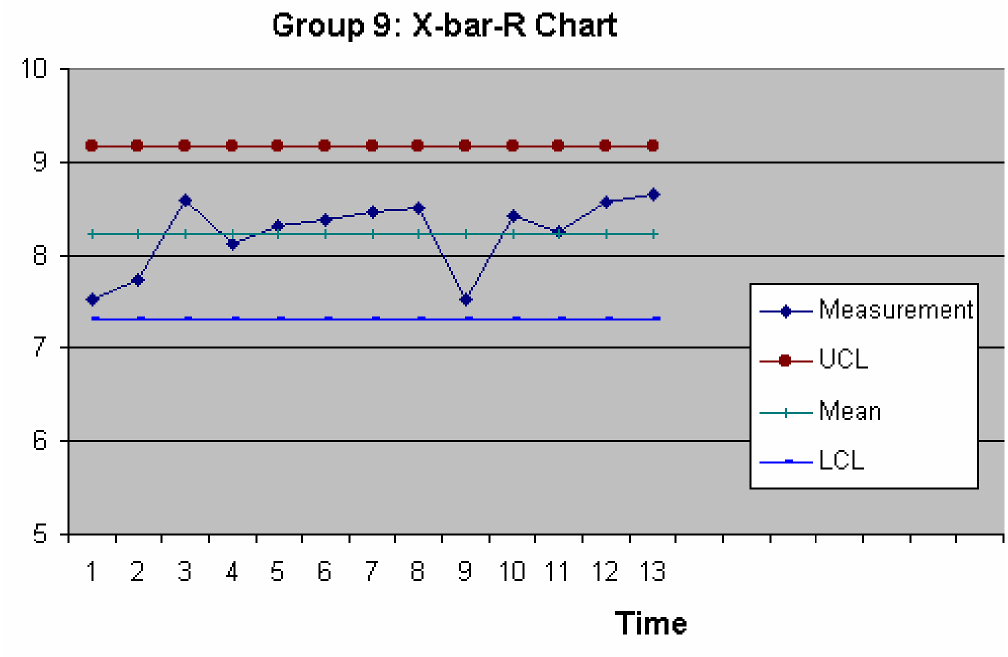


Figure 98. Group 9 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

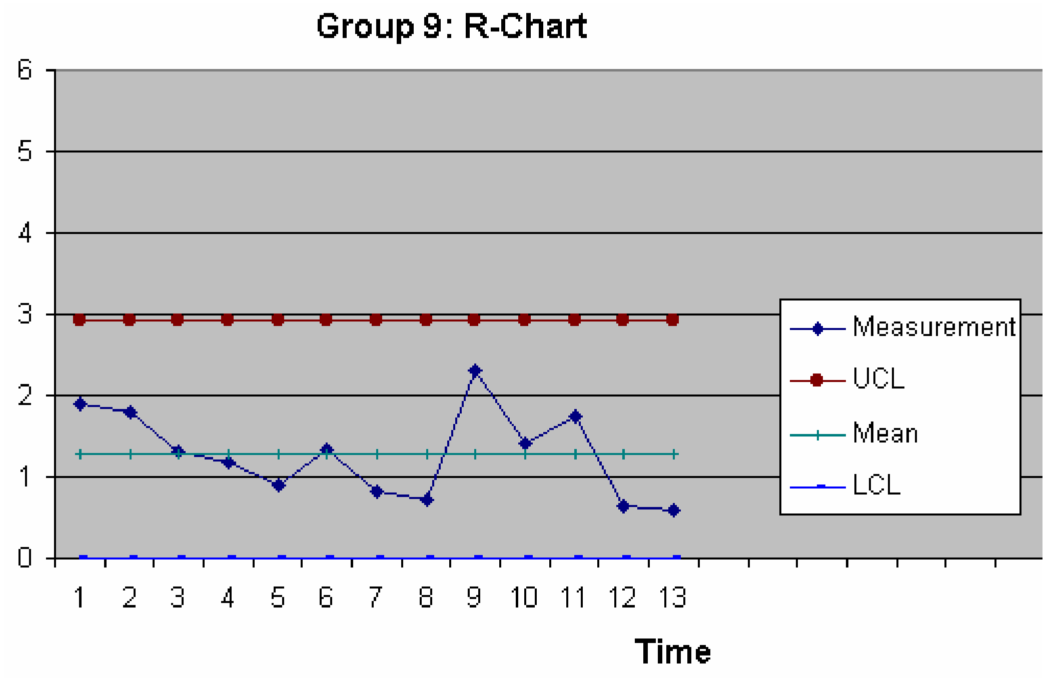


Figure 99. Group 9 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

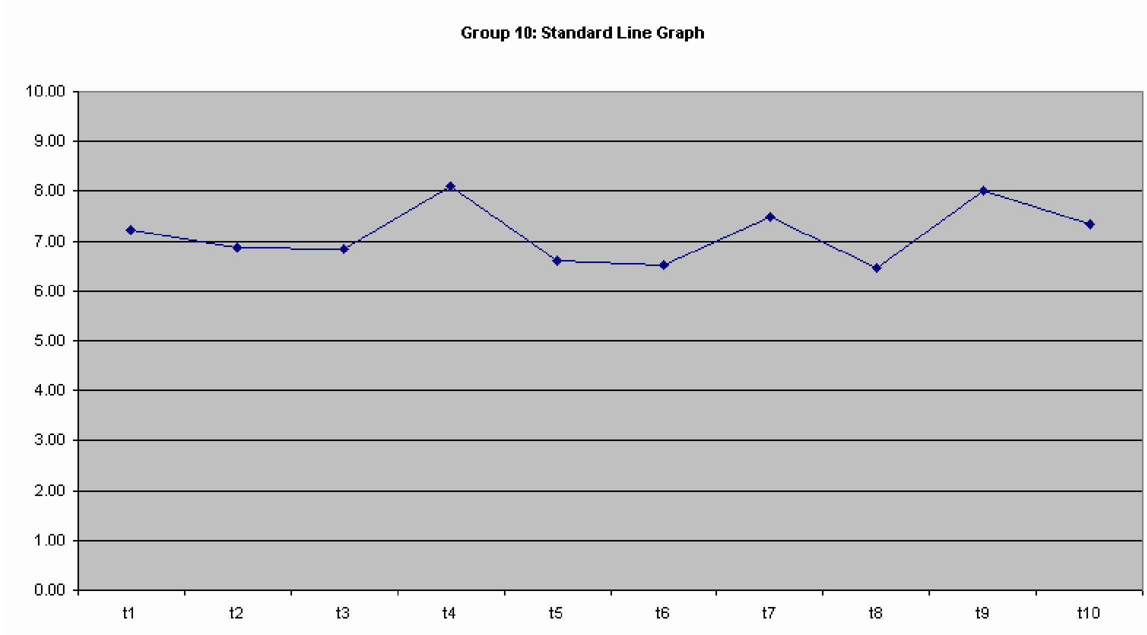


Figure 100. Group 10 (Excel)-Standard line graph: Average satisfaction across weeks.

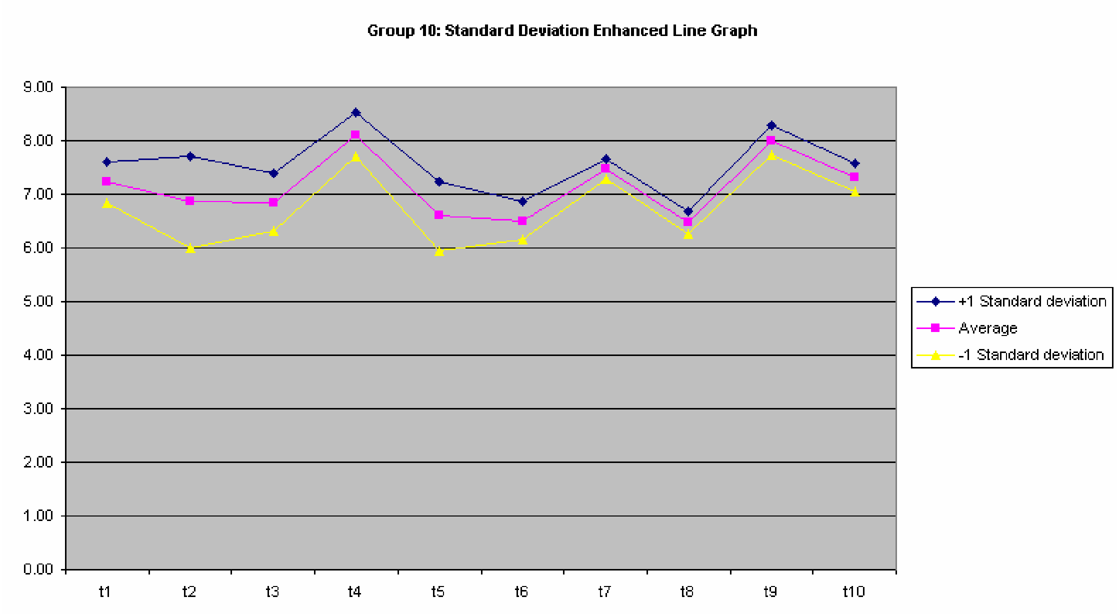


Figure 101. Group 10 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

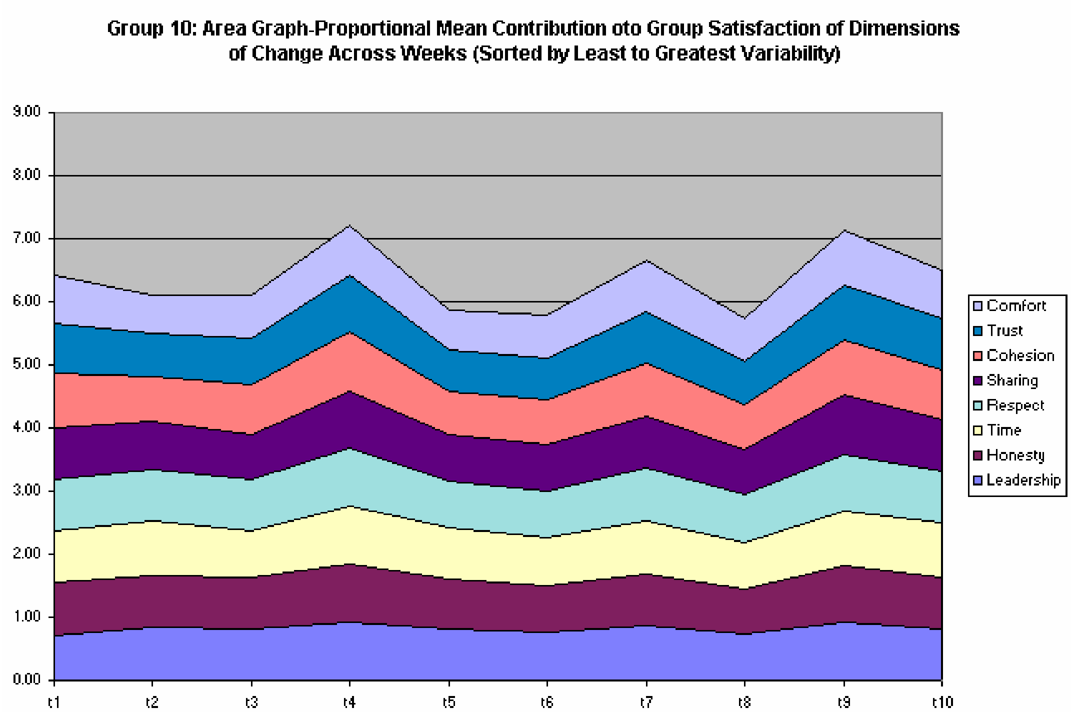


Figure 102. Group 10 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

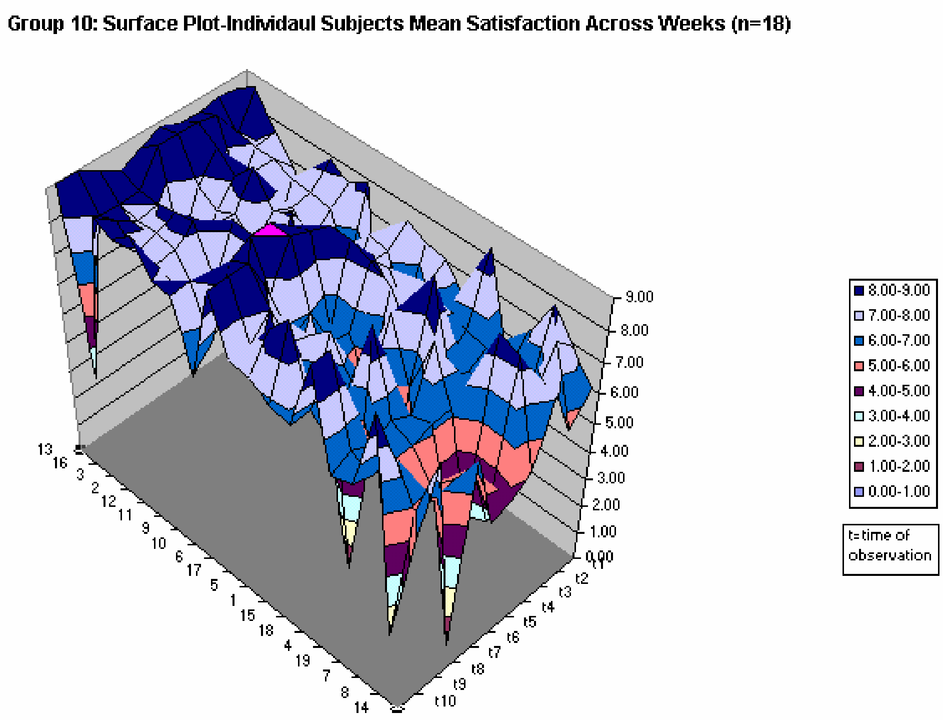


Figure 103. Group 10 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

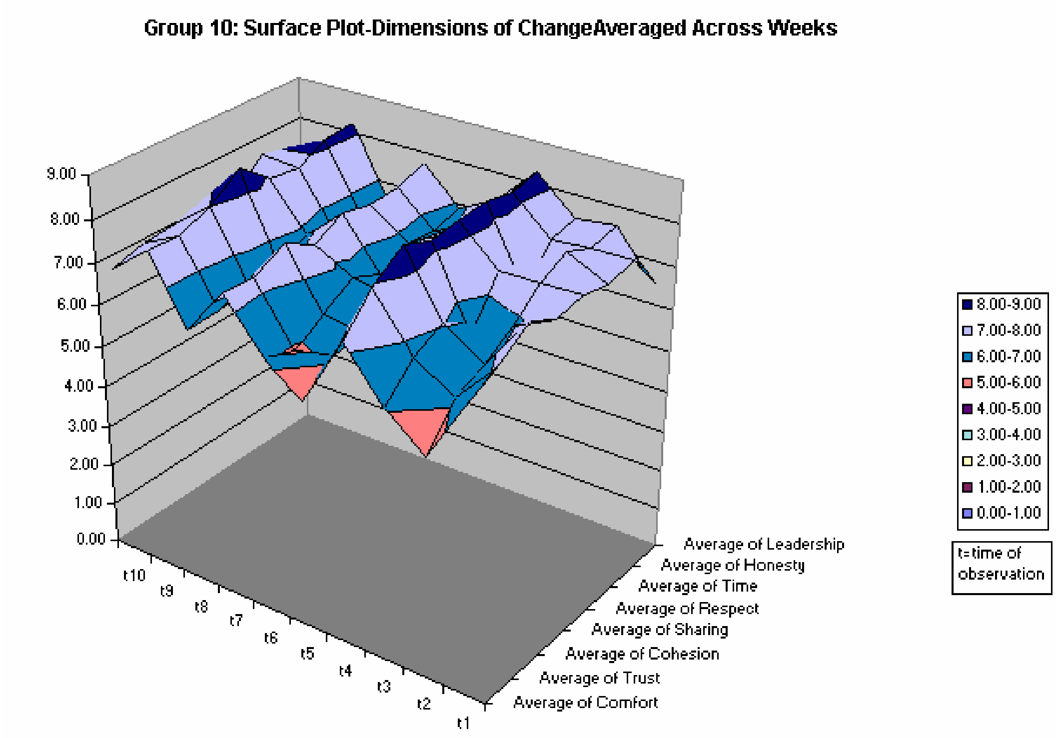


Figure 104. Group 10 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

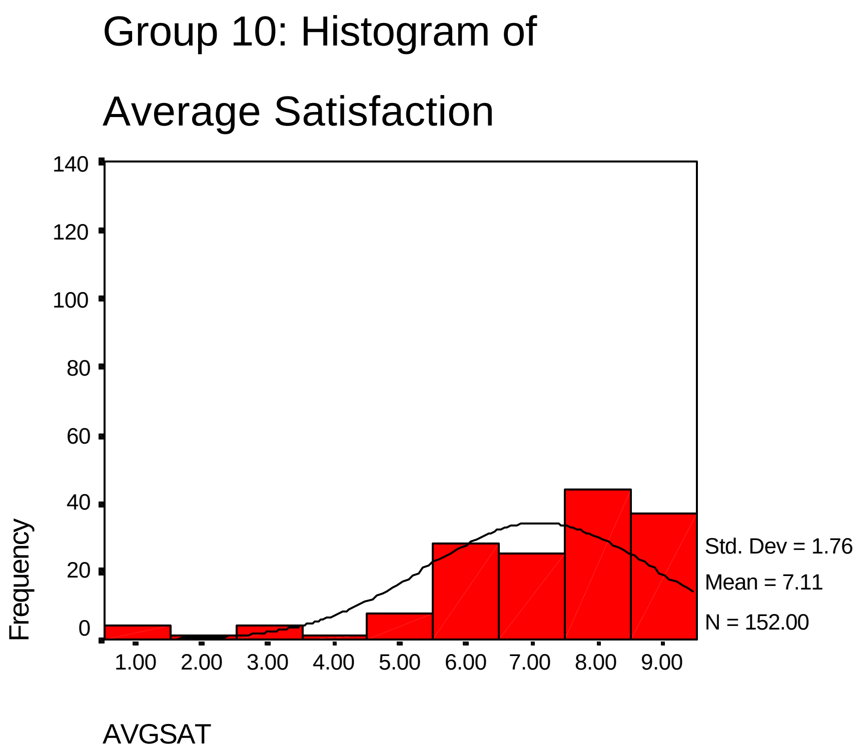


Figure 105. Group 10 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

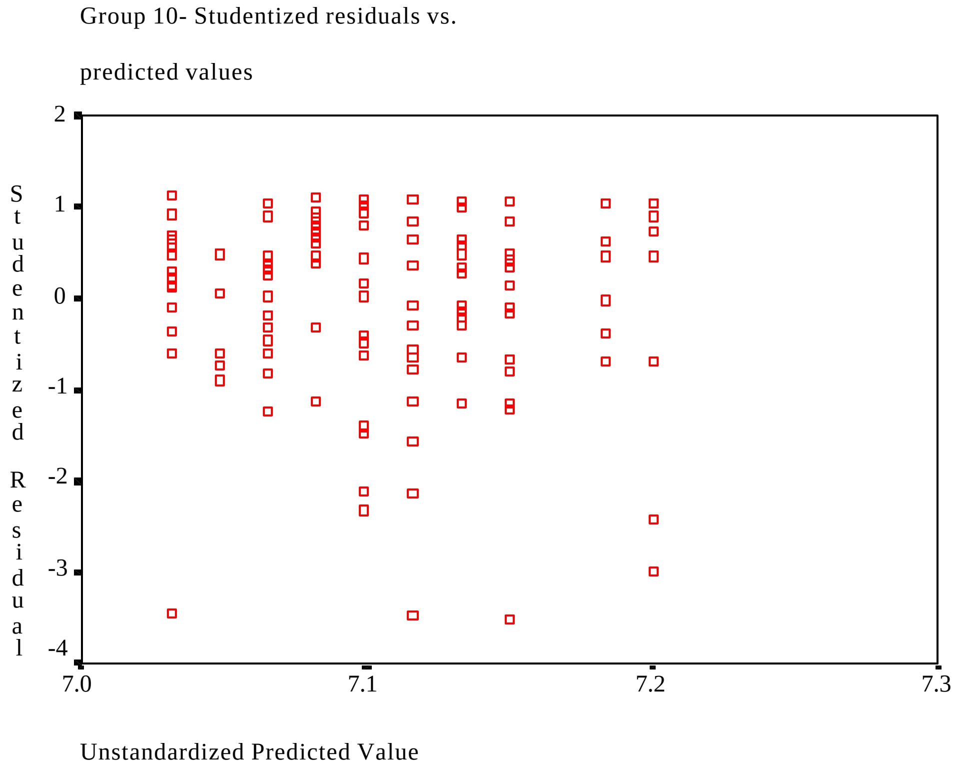


Figure 106. Group 10 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

Group 10-Studentized residuals vs.

order of observations

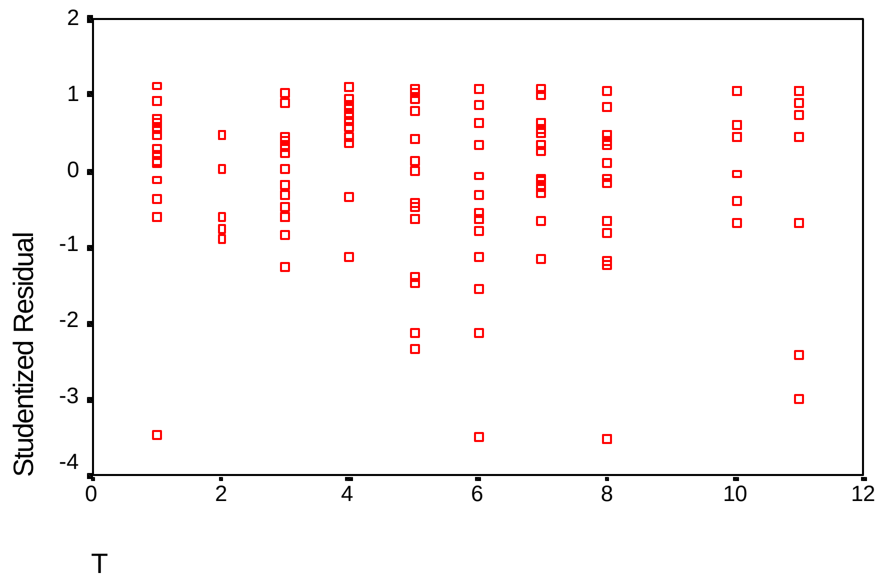


Figure 107. Group 10 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

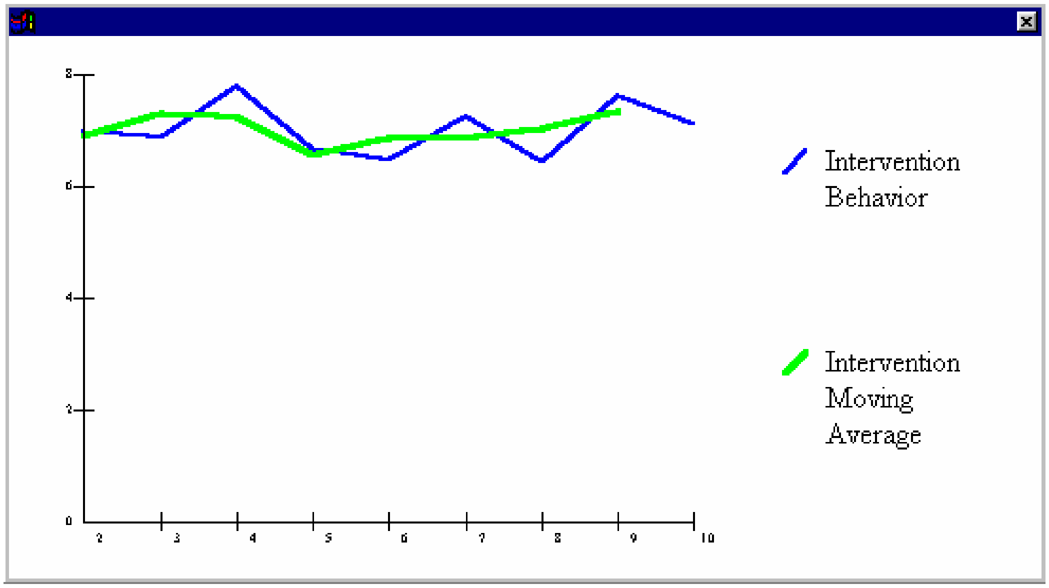


Figure 108. Group 10 (Singwin)-Moving average line: The intervention phase of group measurement.

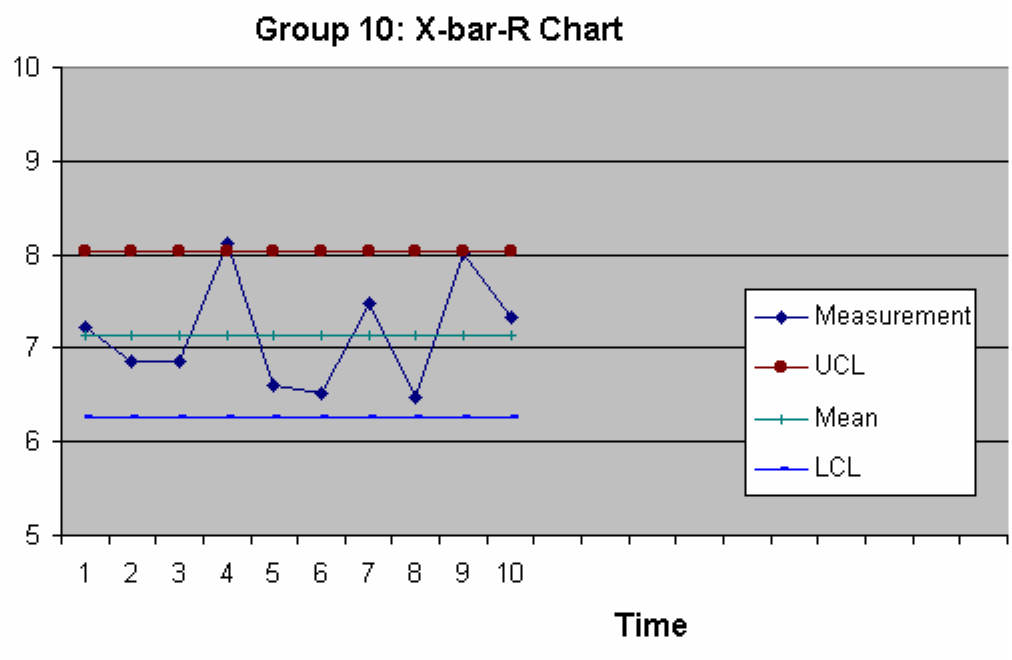


Figure109. Group 10 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

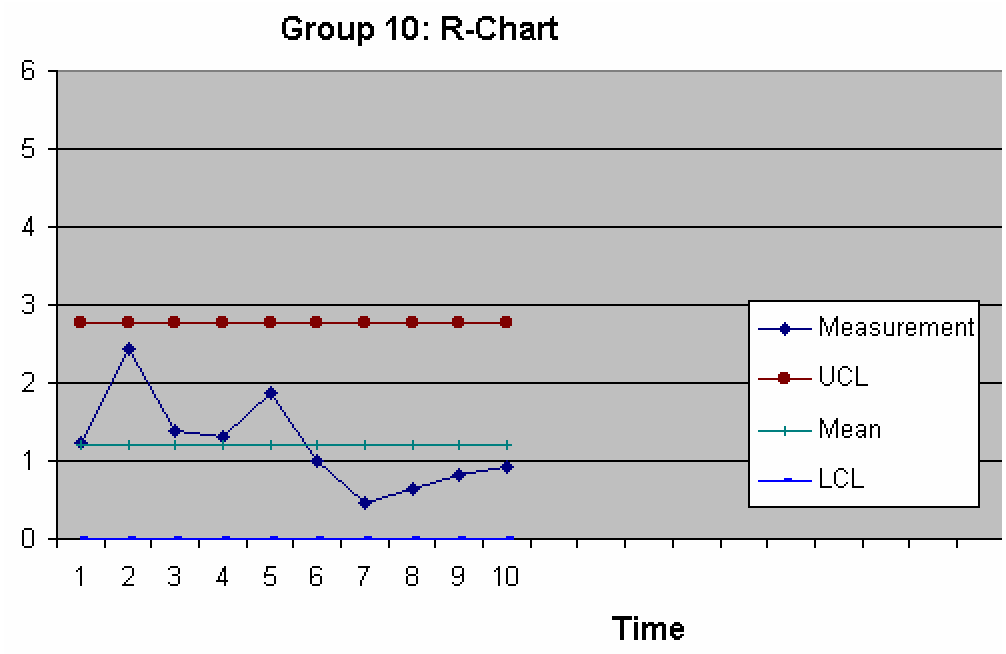


Figure 110. Group 10 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

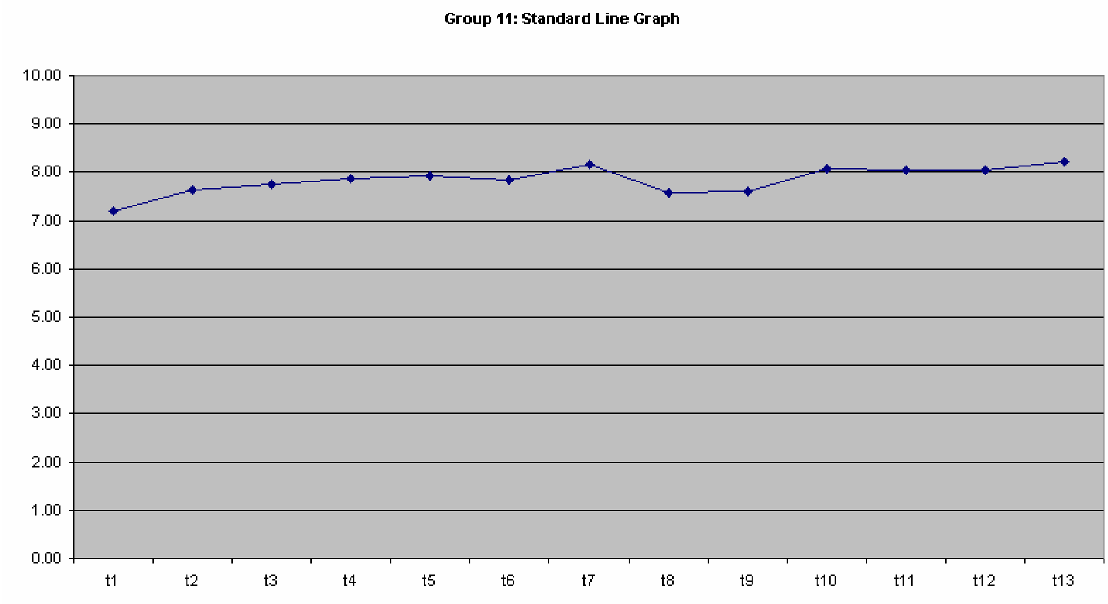


Figure 111. Group 11 (Excel)-Standard line graph: Average satisfaction across weeks.

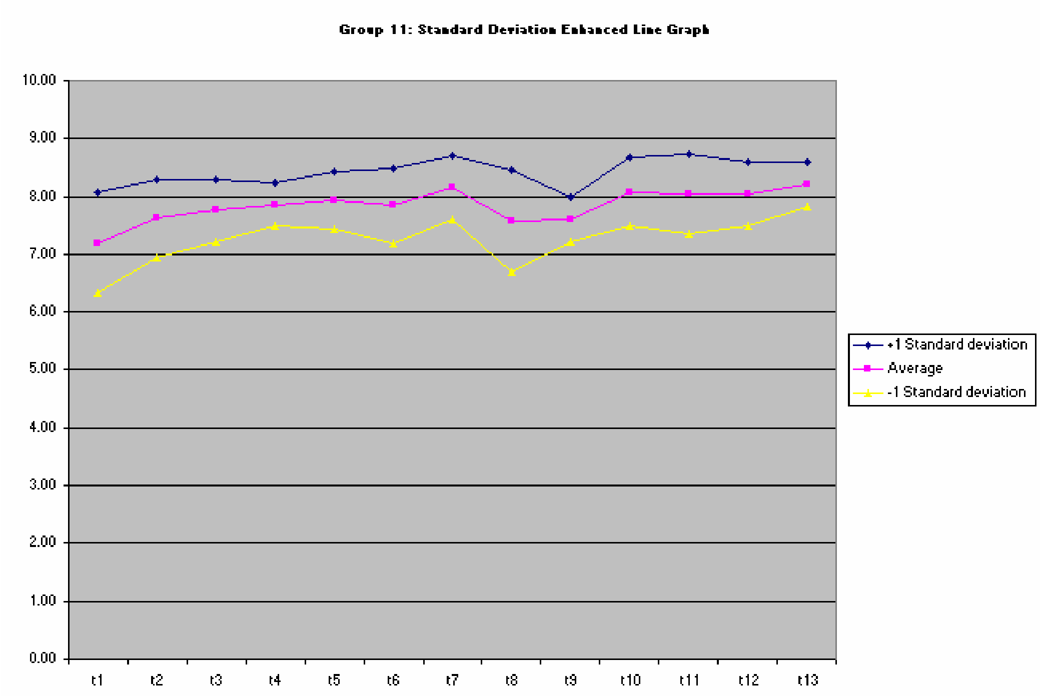


Figure 112. Group 11 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

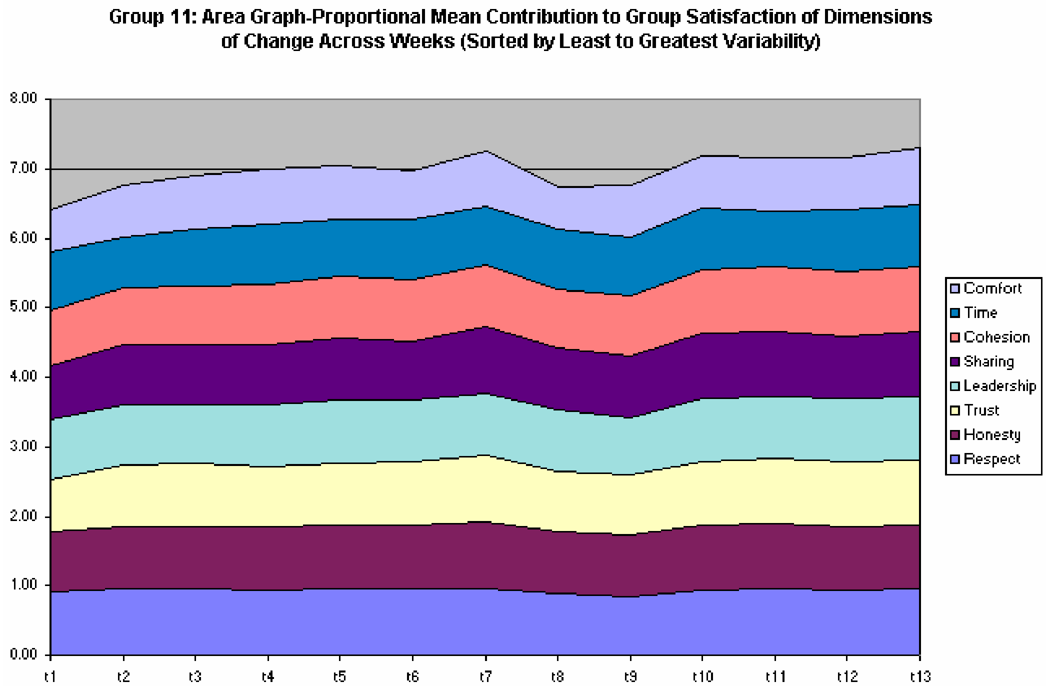


Figure 113. Group 11 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

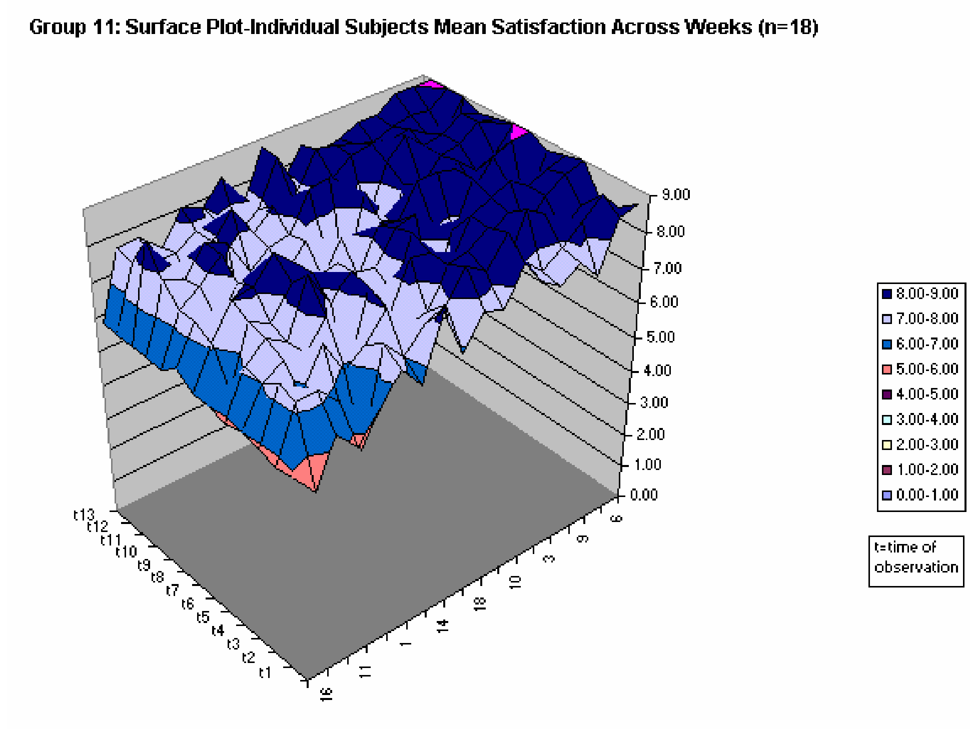


Figure 114. Group 11 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

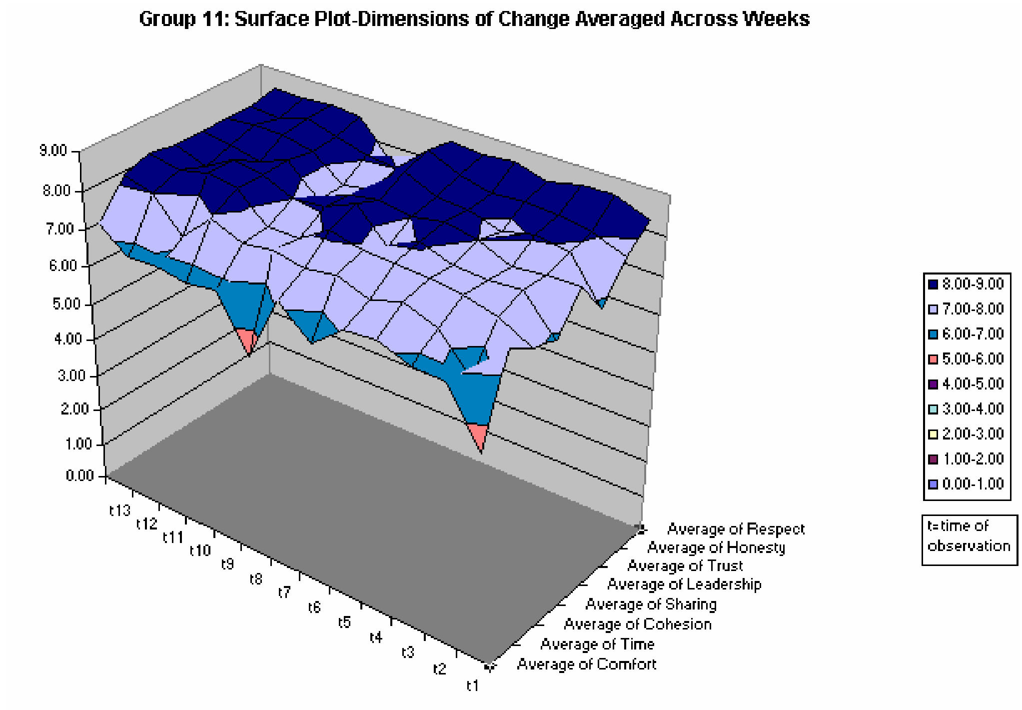


Figure 115. Group 11 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

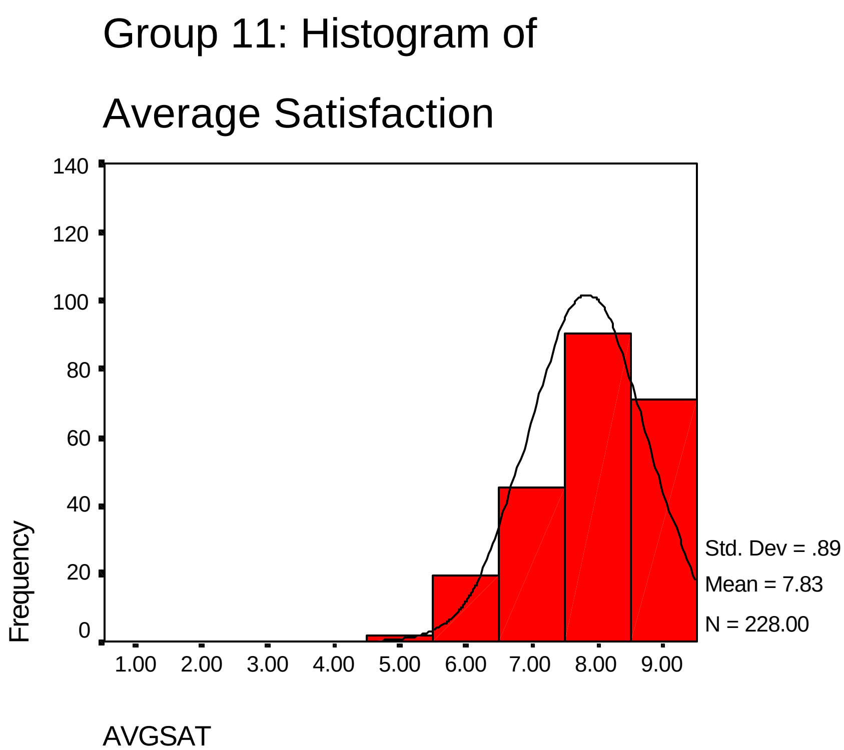


Figure 116. Group 11 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

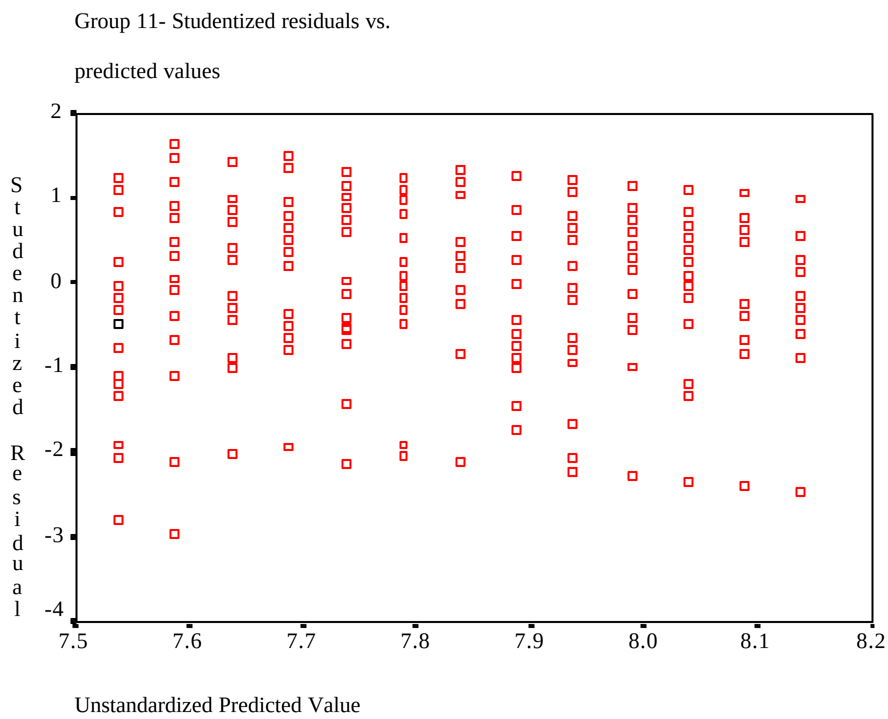


Figure 117. Group 11 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

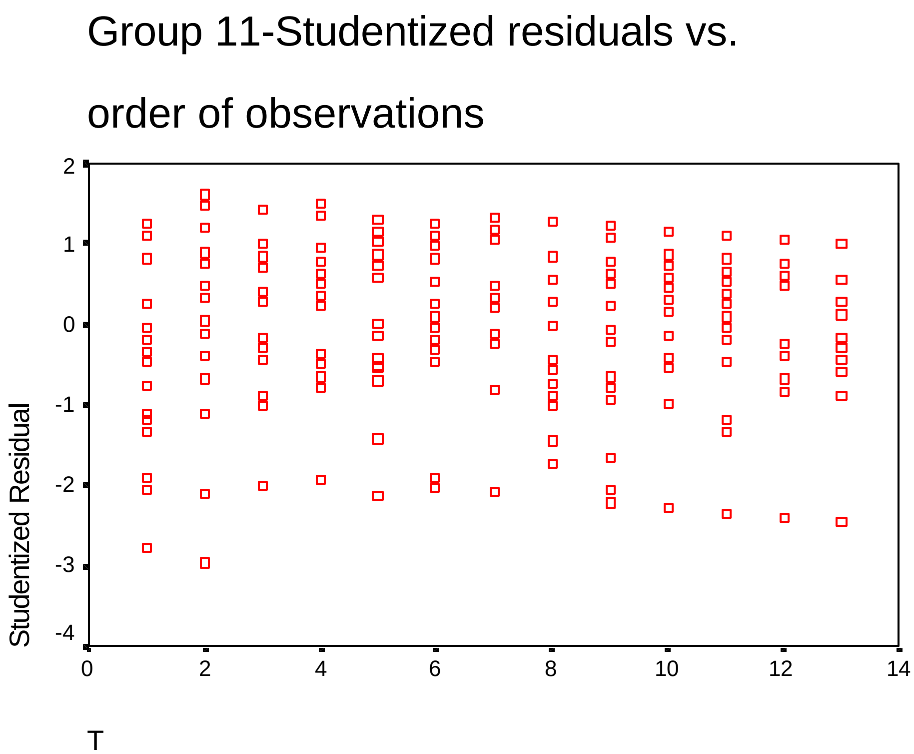


Figure 118. Group 11 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

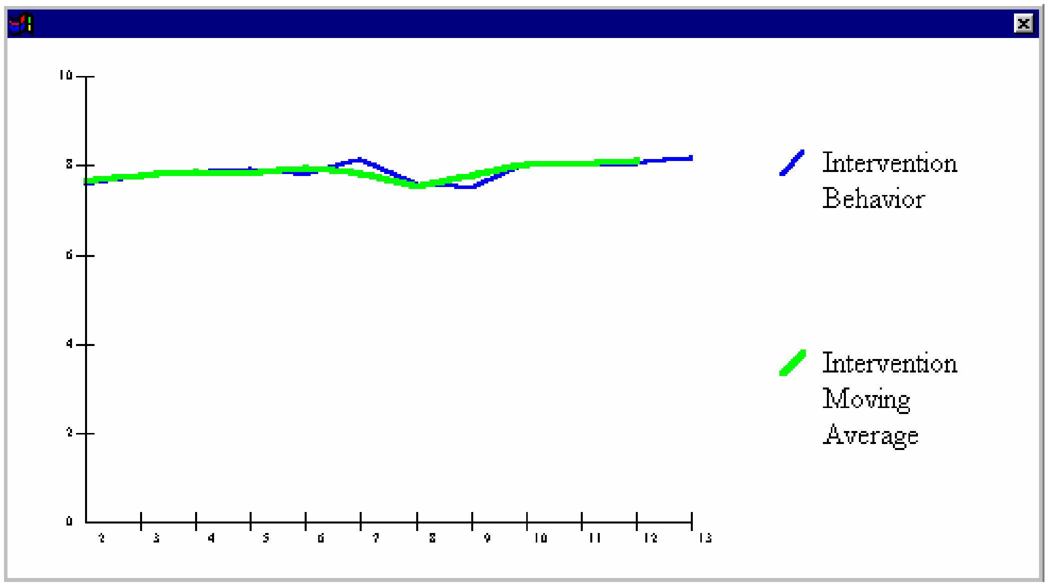


Figure 119. Group 11 (Singwin)-Moving average line: The intervention phase of group measurement.

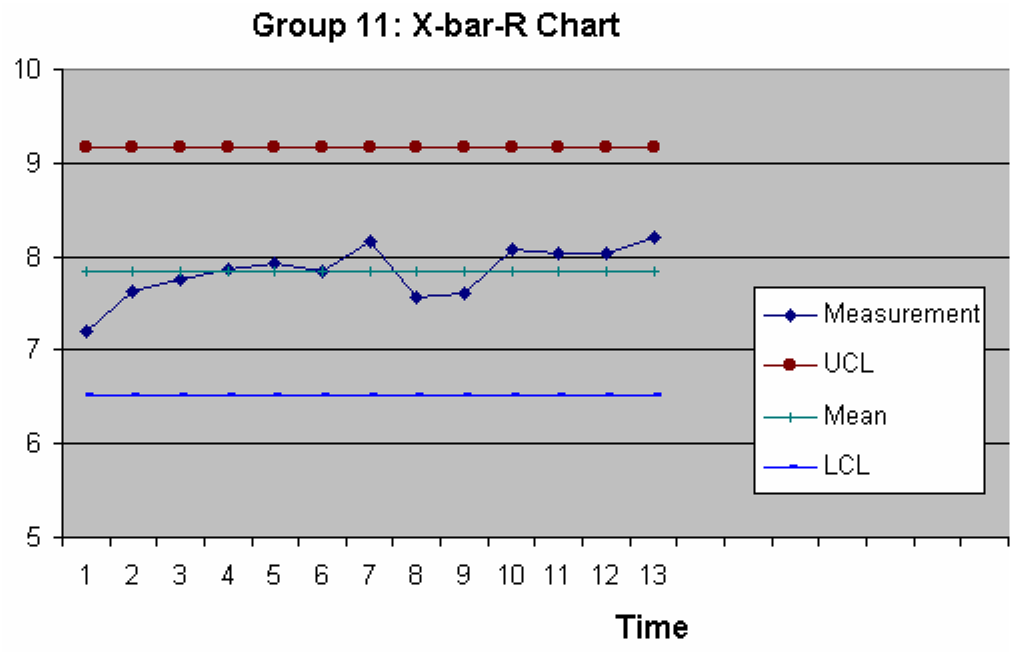


Figure 120. Group 11 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

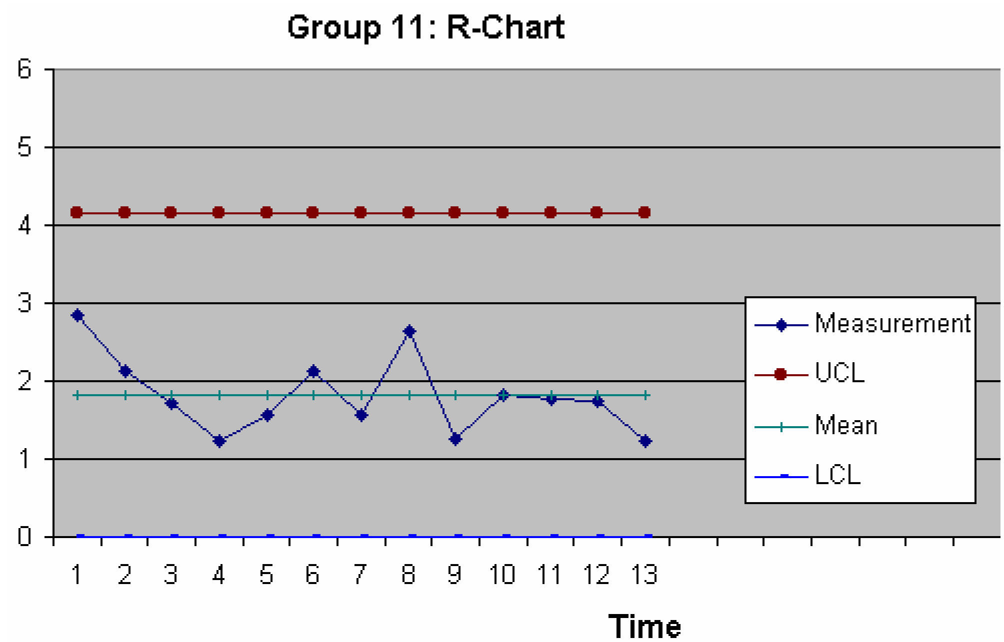


Figure 121. Group 11 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

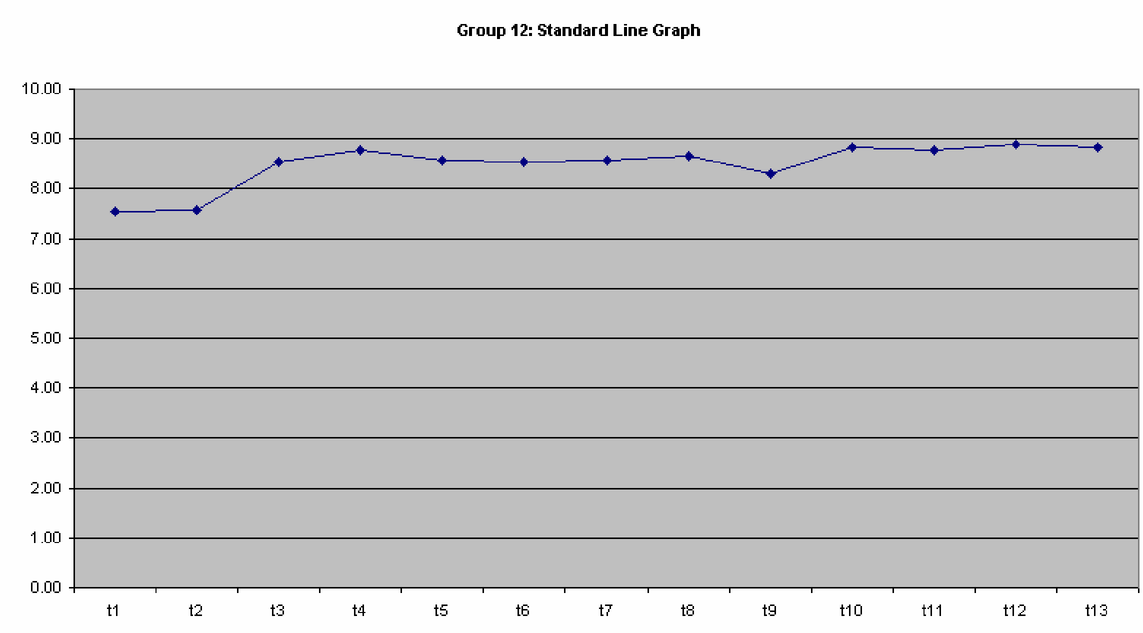


Figure 122. Group 12 (Excel)-Standard line graph: Average satisfaction across weeks.

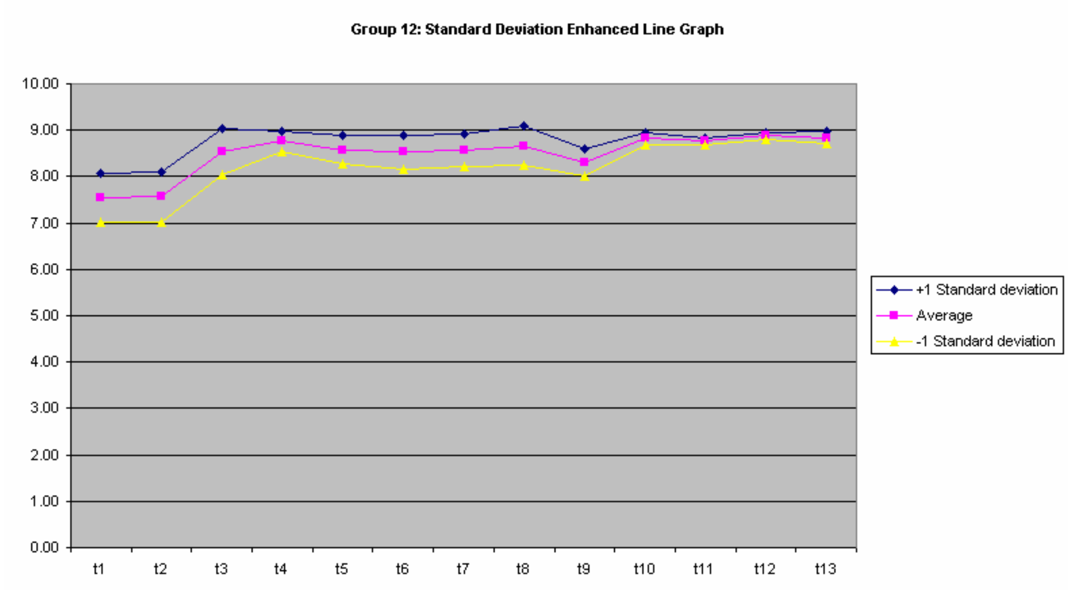


Figure 123. Group 12 (Excel)-Standard deviation enhanced line graph (SDELG):

Concordance and variation of group satisfaction across weeks.

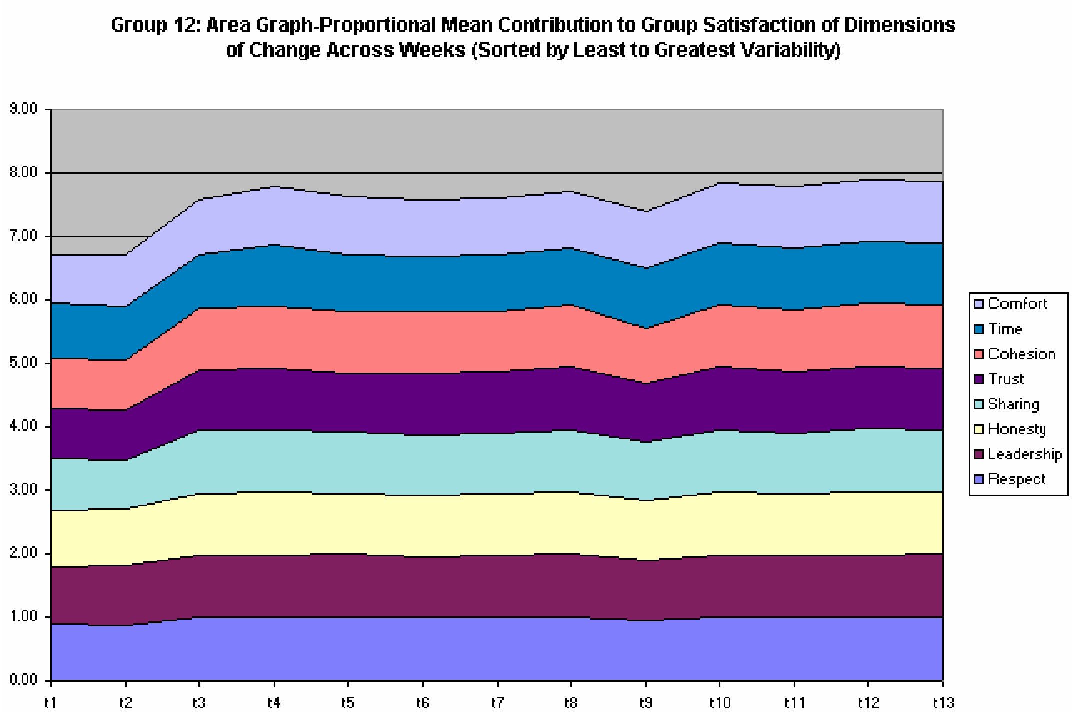


Figure 124. Group 12 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

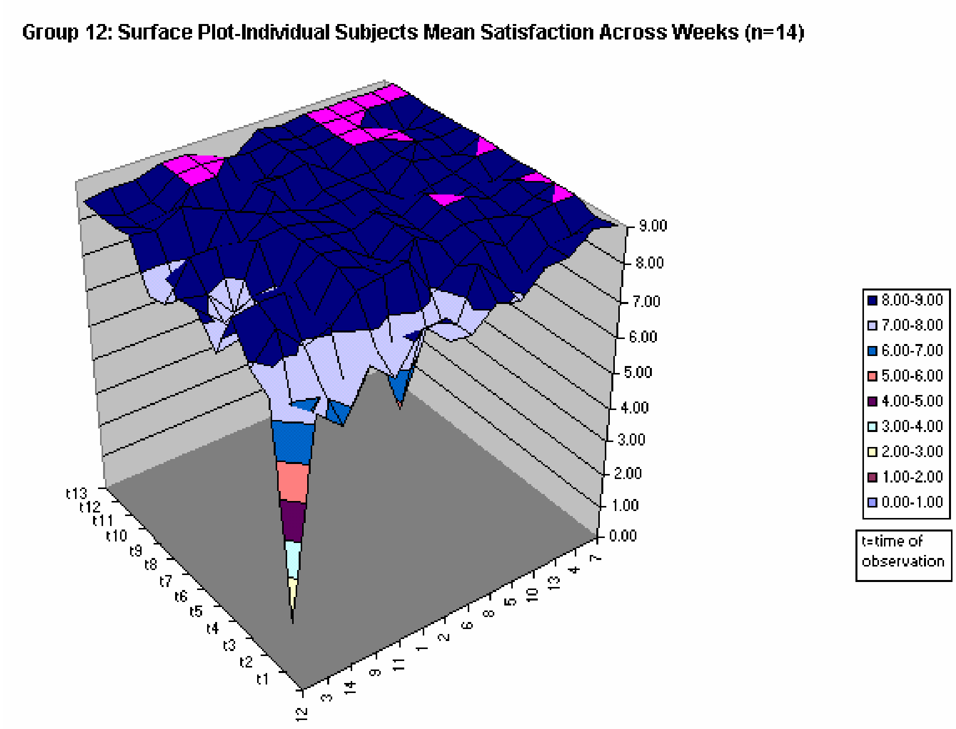


Figure 125. Group 12 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

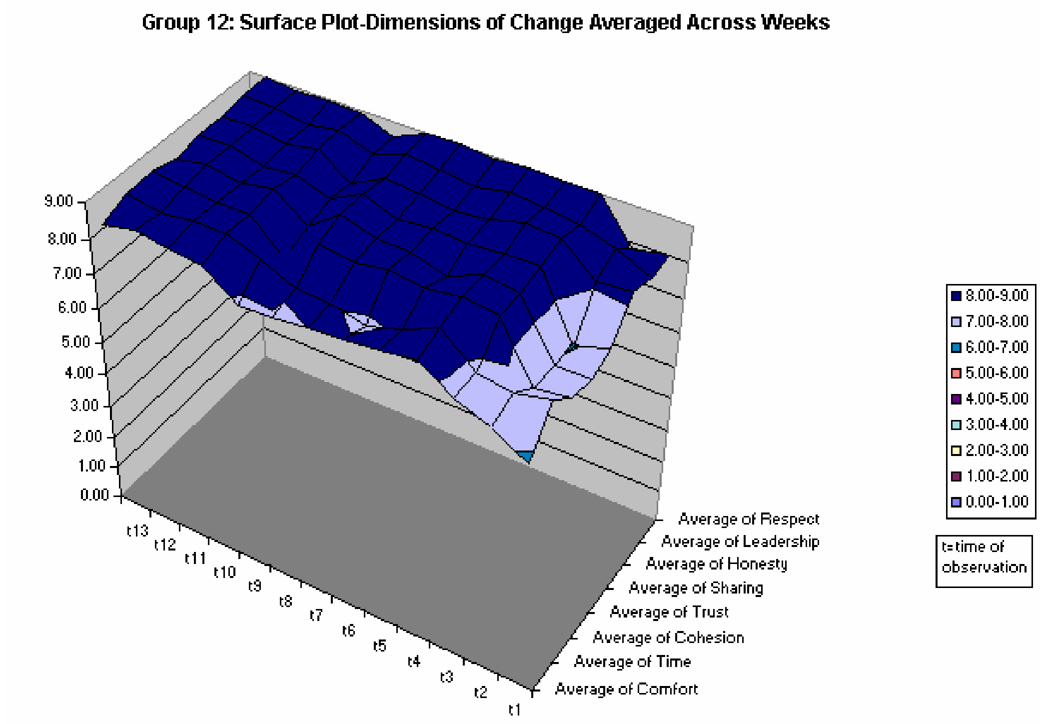


Figure 126. Group 12 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

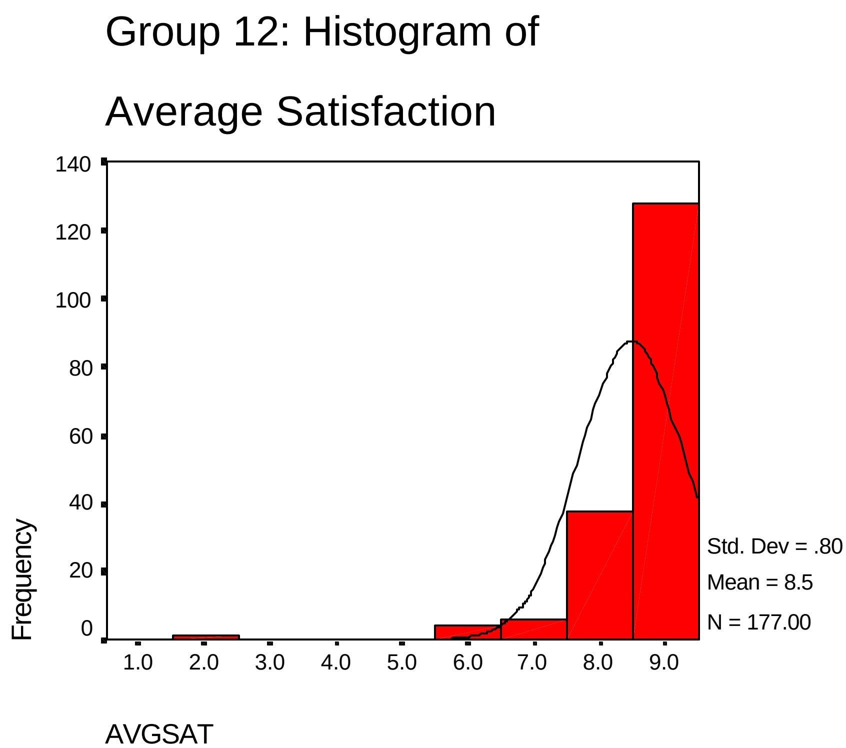


Figure 127. Group 12 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

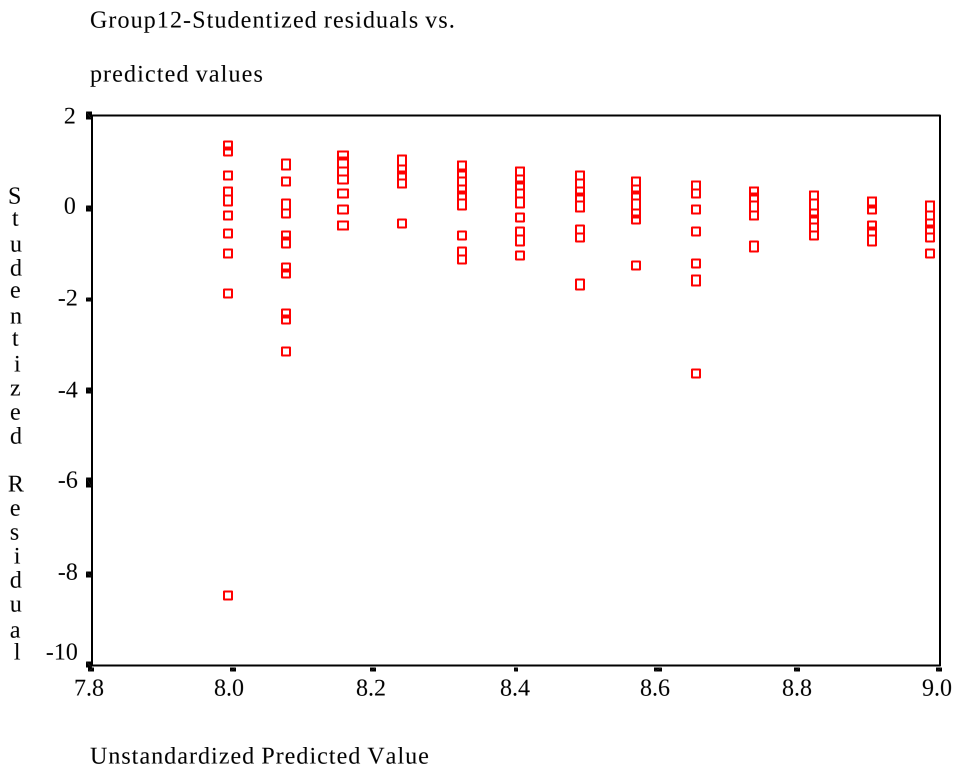


Figure 128. Group 12 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

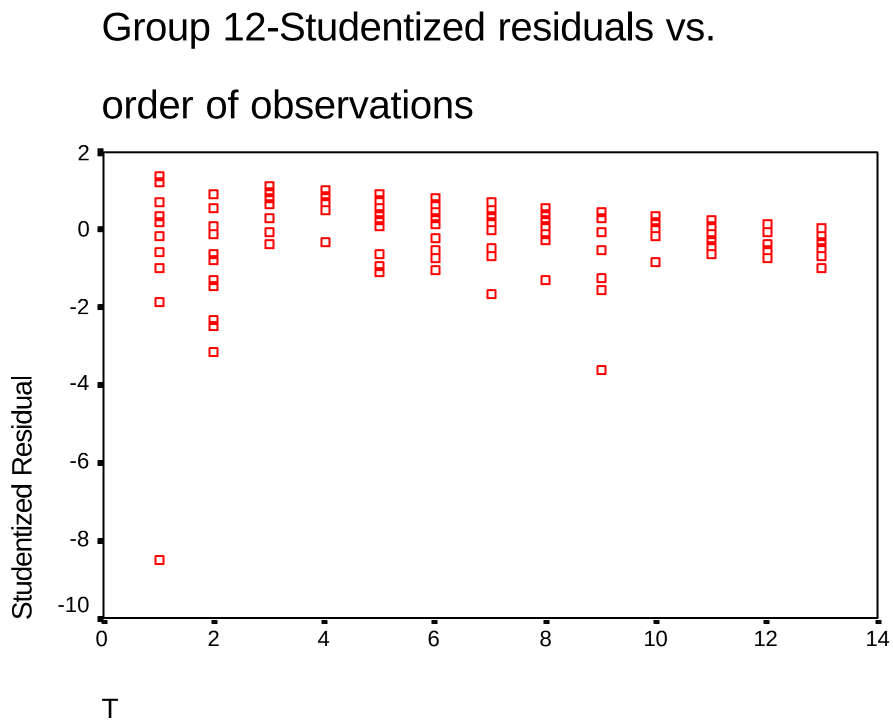


Figure 129. Group 12 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

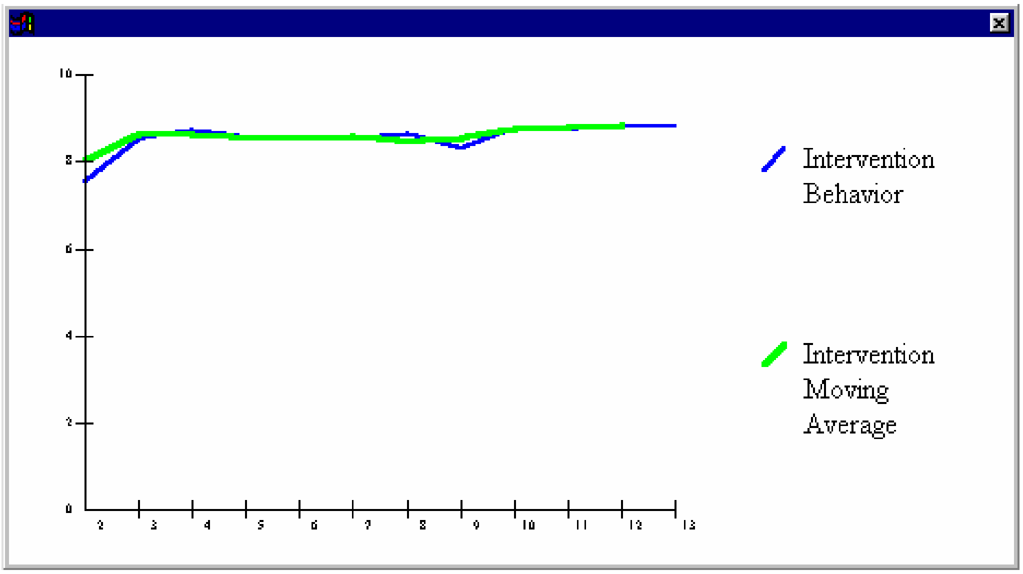


Figure 130. Group 12 (Singwin)-Moving average line: The intervention phase of group measurement.

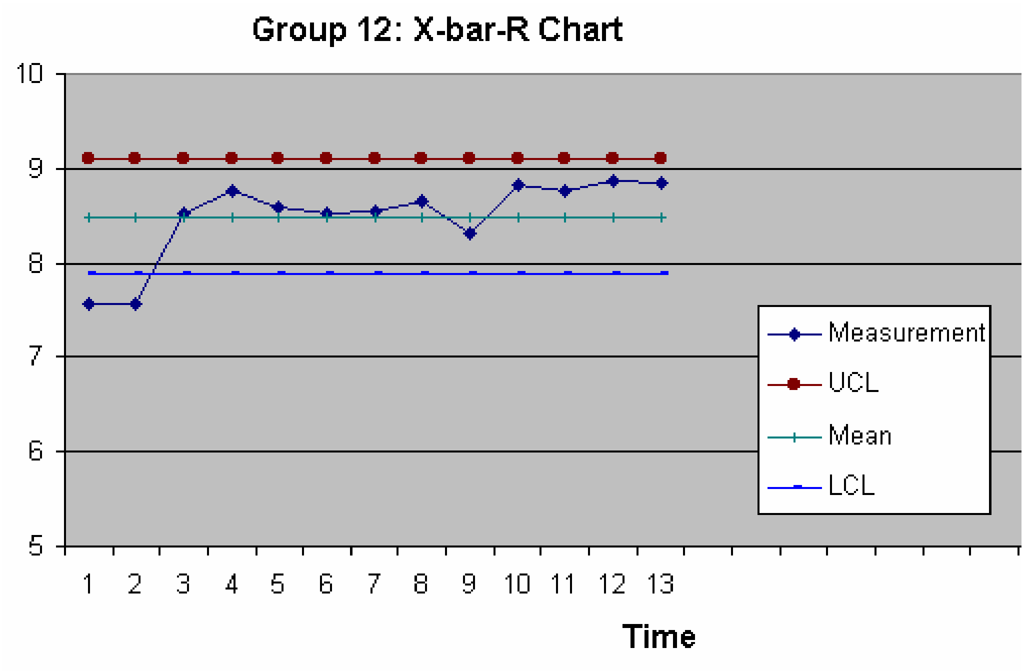


Figure 131. Group 12 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

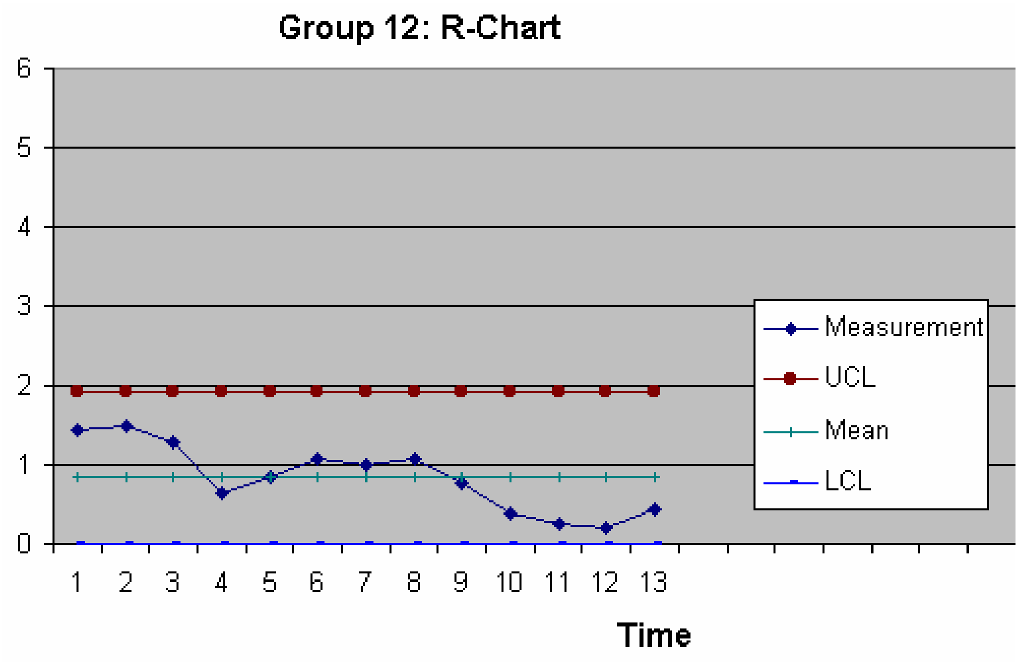


Figure 132. Group 12 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

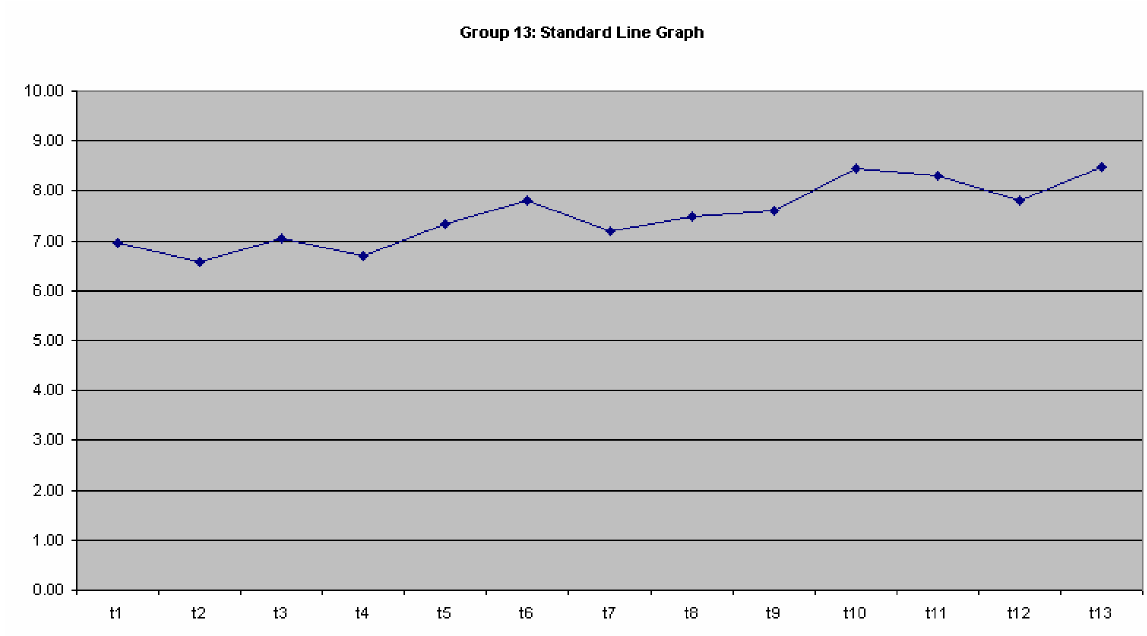


Figure 133. Group 13 (Excel)-Standard line graph: Average satisfaction across weeks.

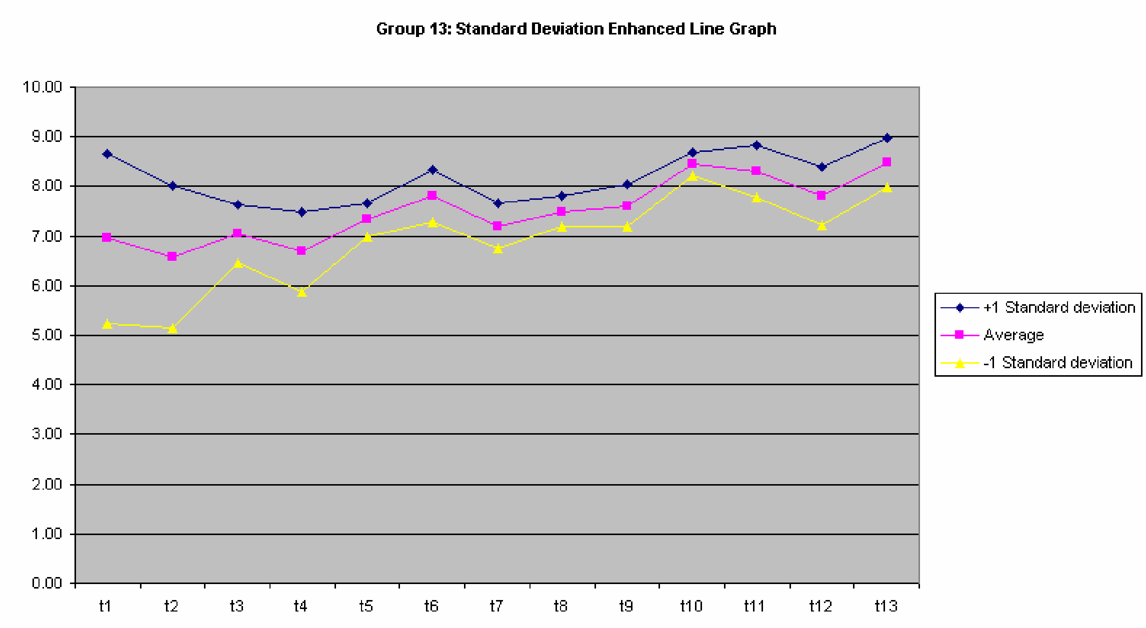


Figure 134. Group 13 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

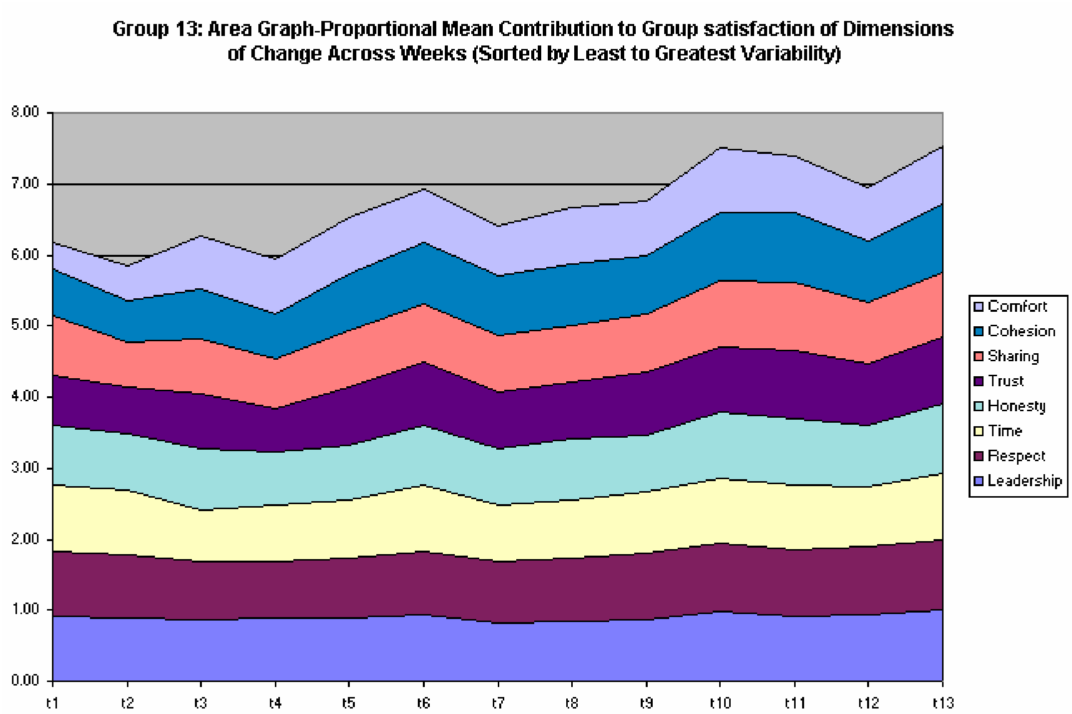


Figure 135. Group 13 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

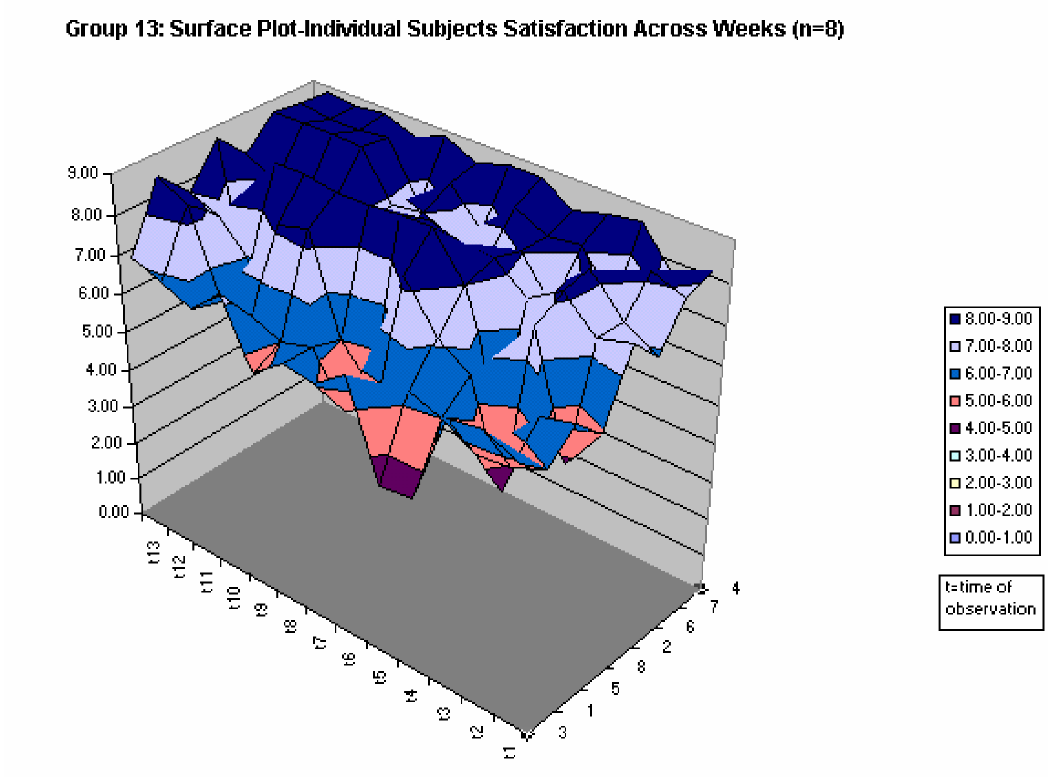


Figure 136. Group 13 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

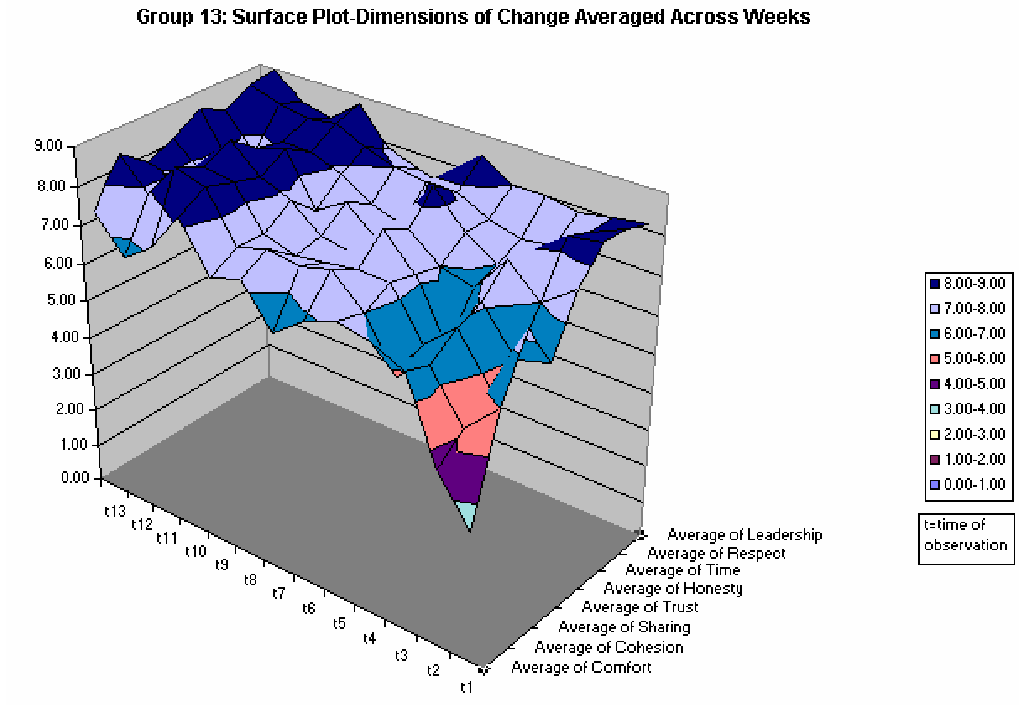


Figure 137. Group 13 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

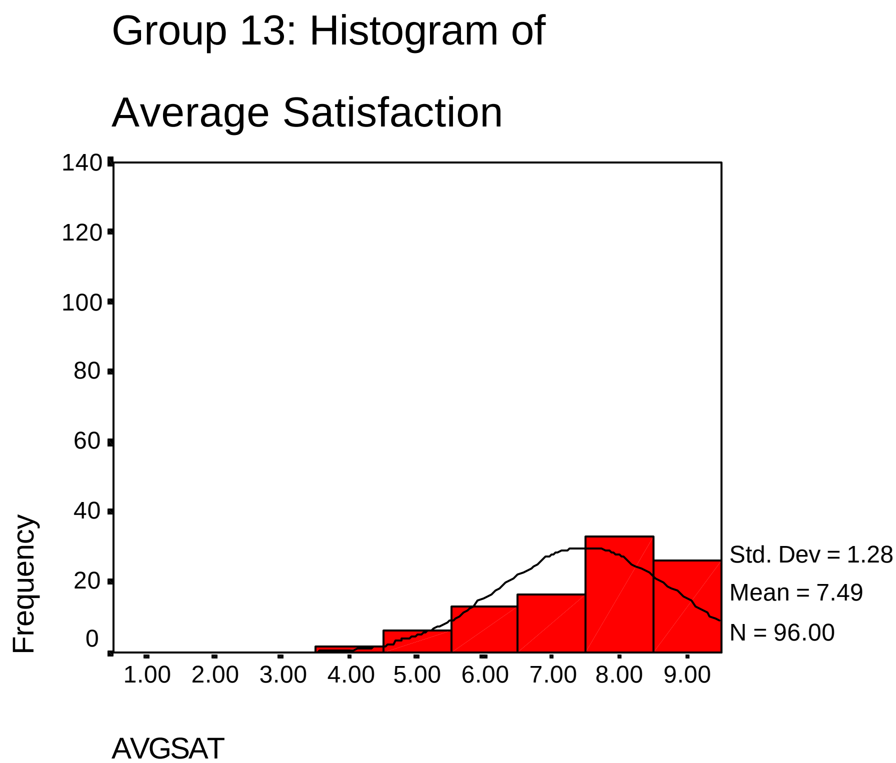


Figure 138. Group 13 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

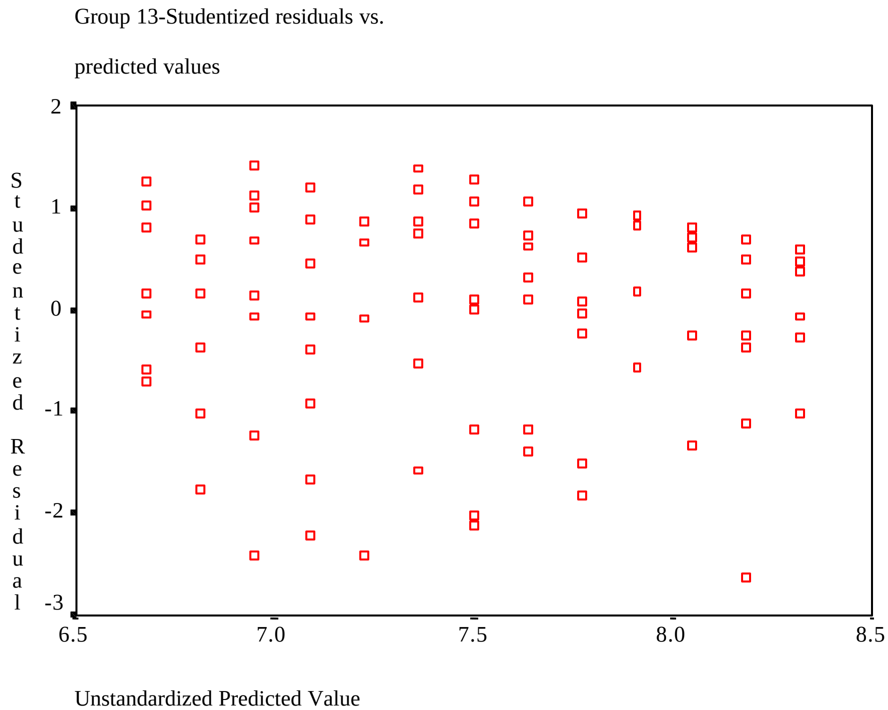


Figure 139. Group 13 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

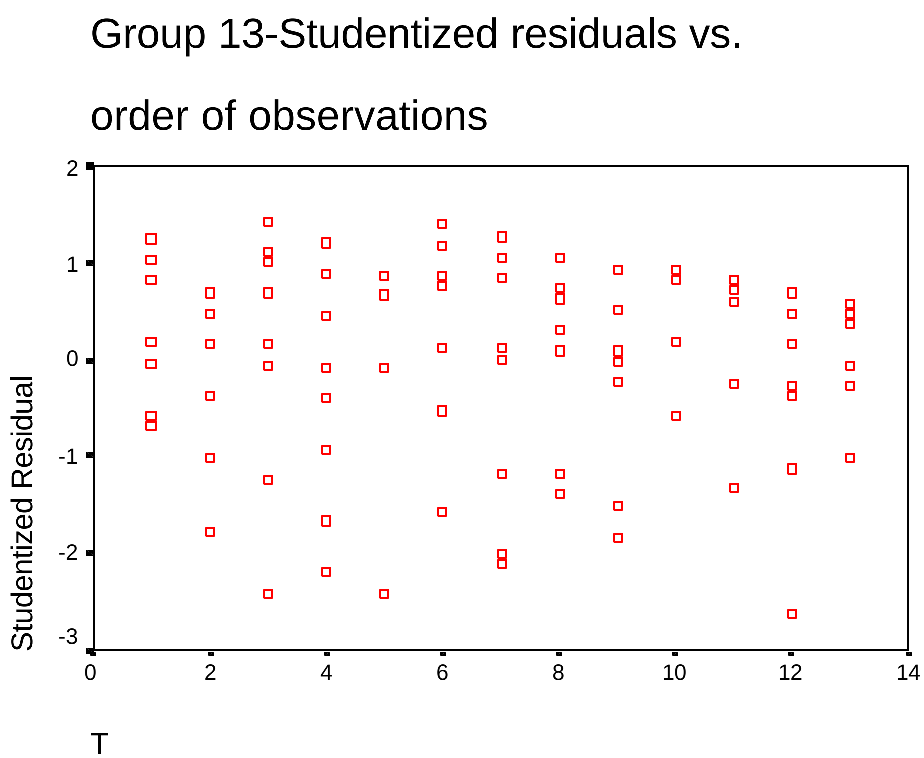


Figure 140. Group 13 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

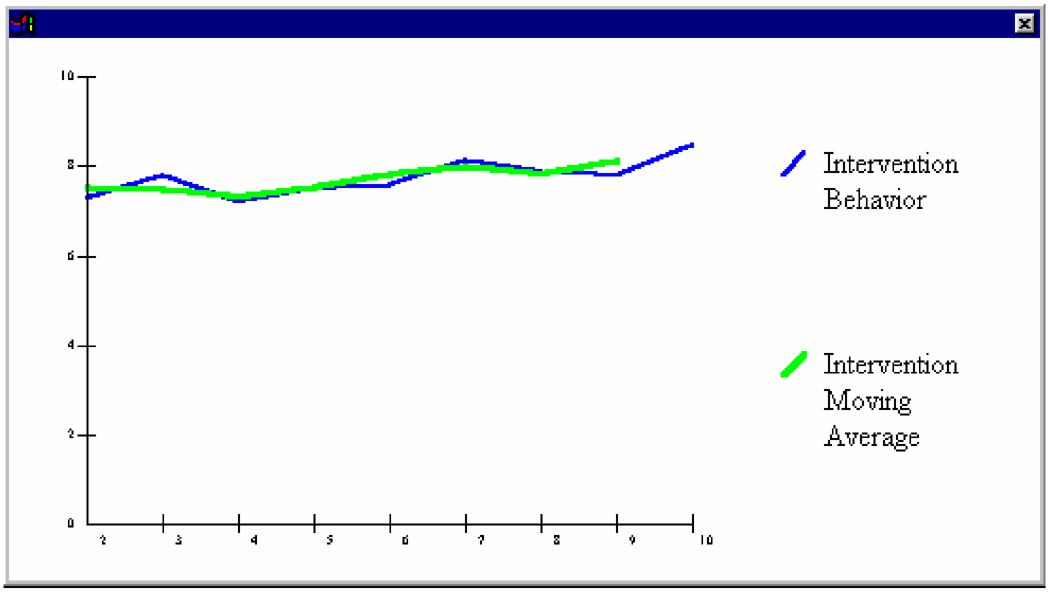


Figure 141. Group 13 (Singwin)-Moving average line: The intervention phase of group measurement.

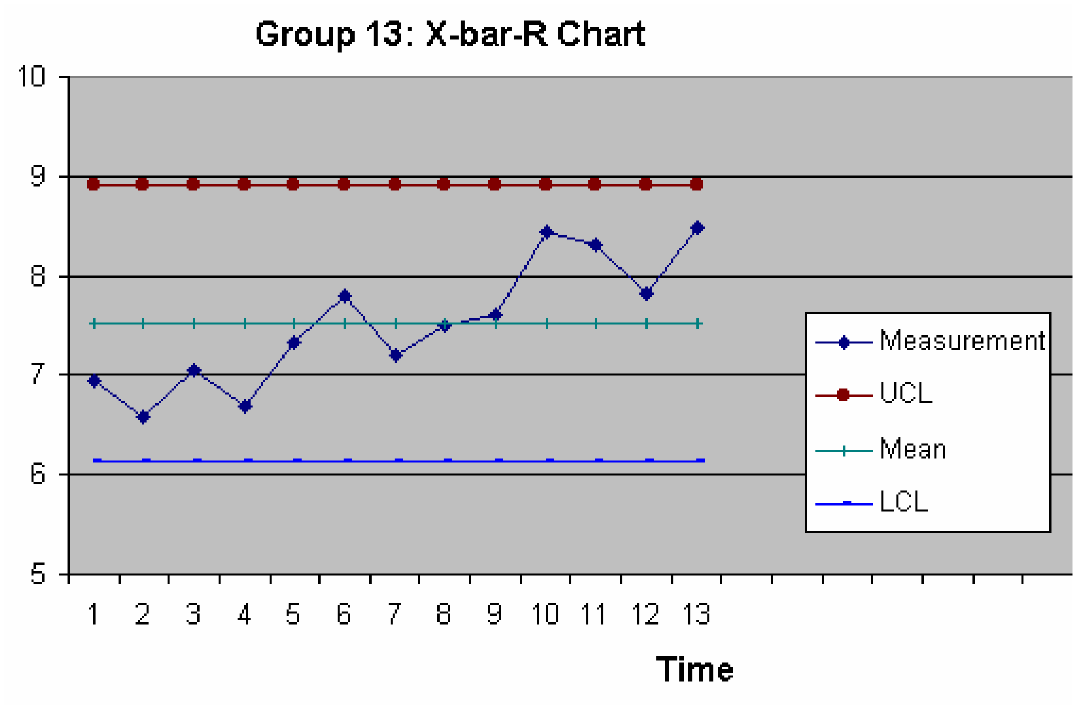


Figure 142. Group 13 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

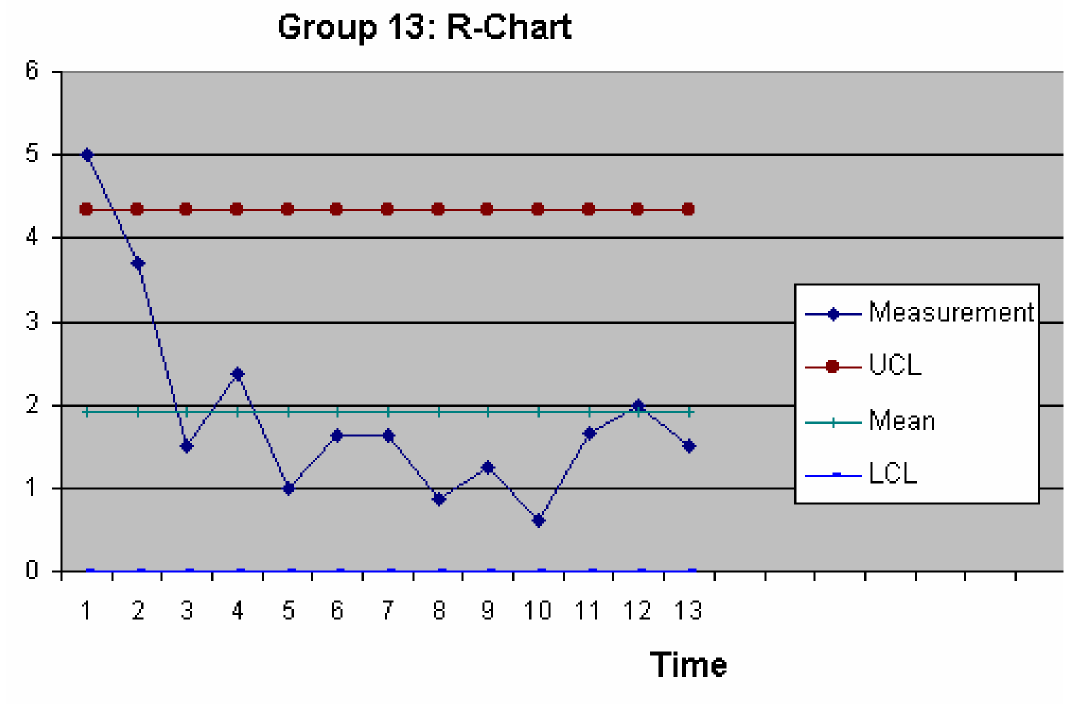


Figure 143. Group 13 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

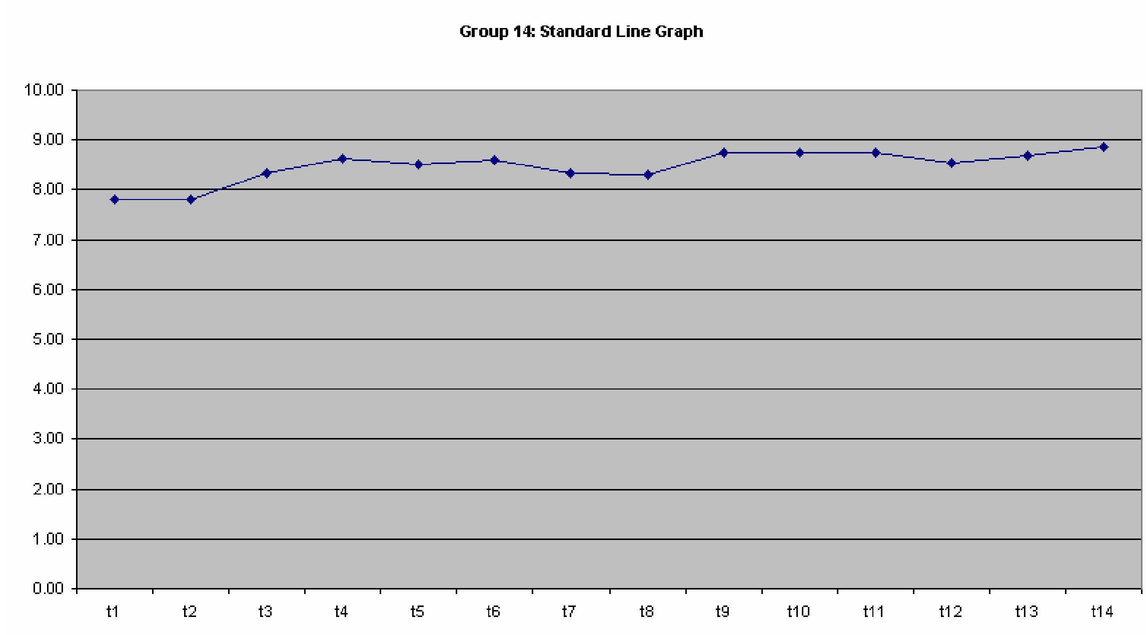


Figure 144. Group 14 (Excel)-Standard line graph: Average satisfaction across weeks.

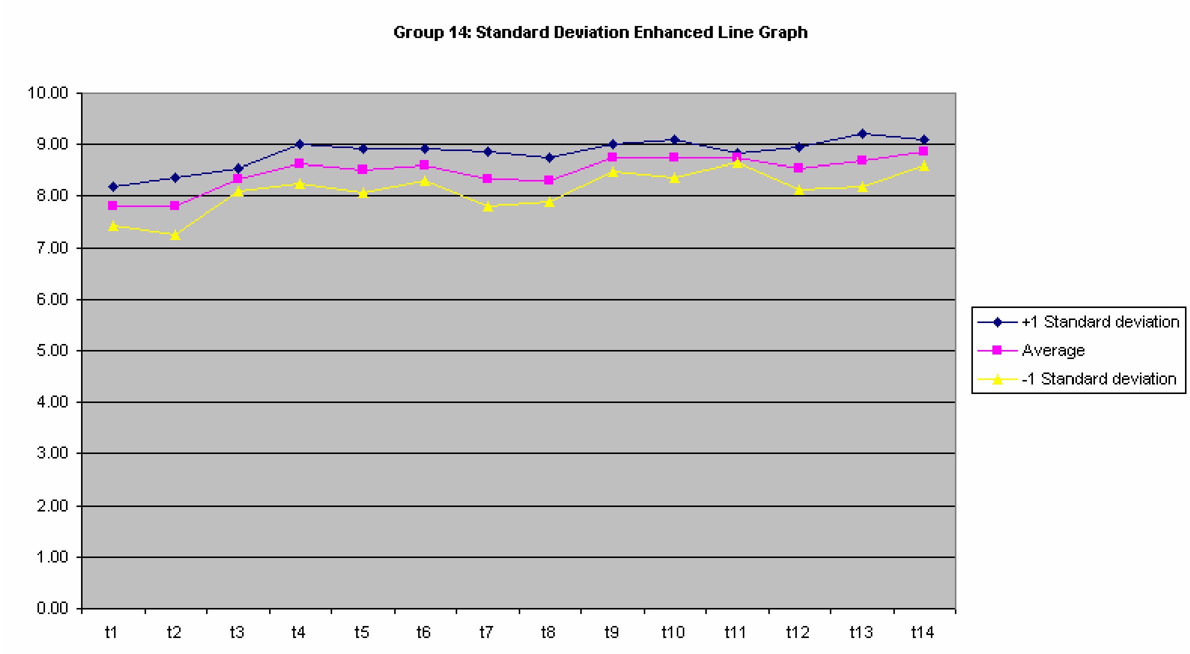


Figure 145. Group 14 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

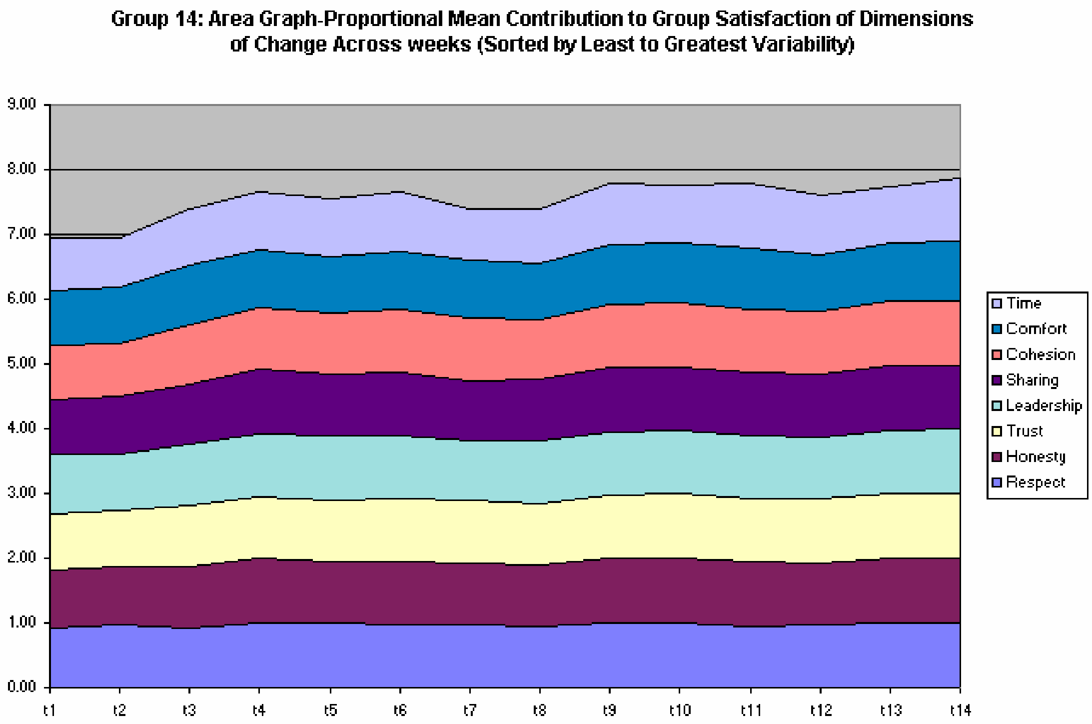


Figure 146. Group 14 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

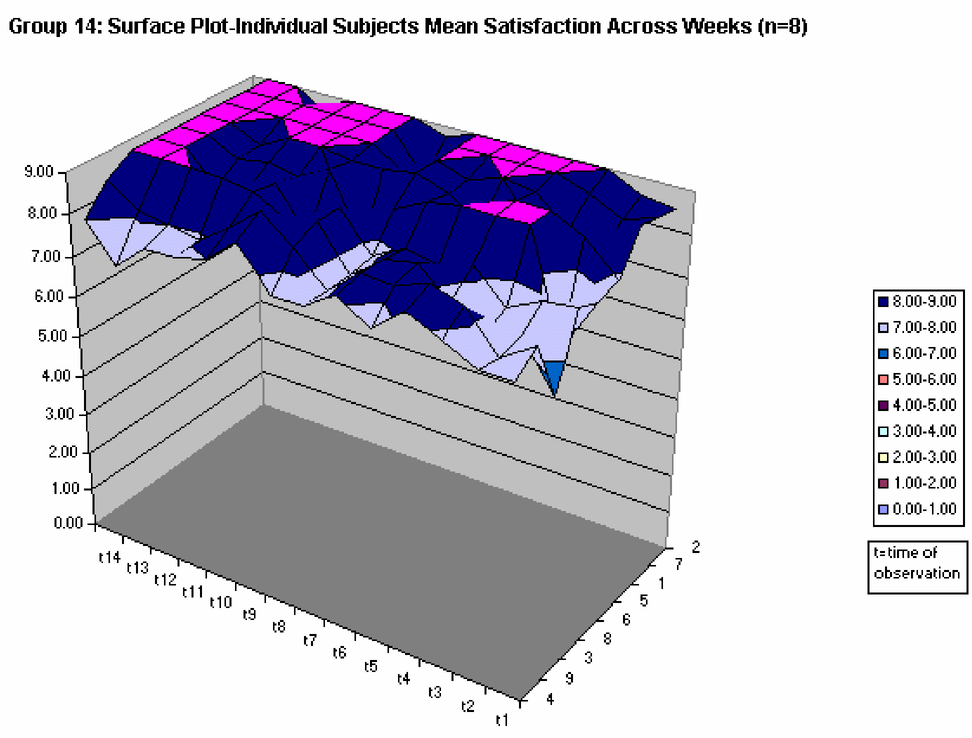


Figure 147. Group 14 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

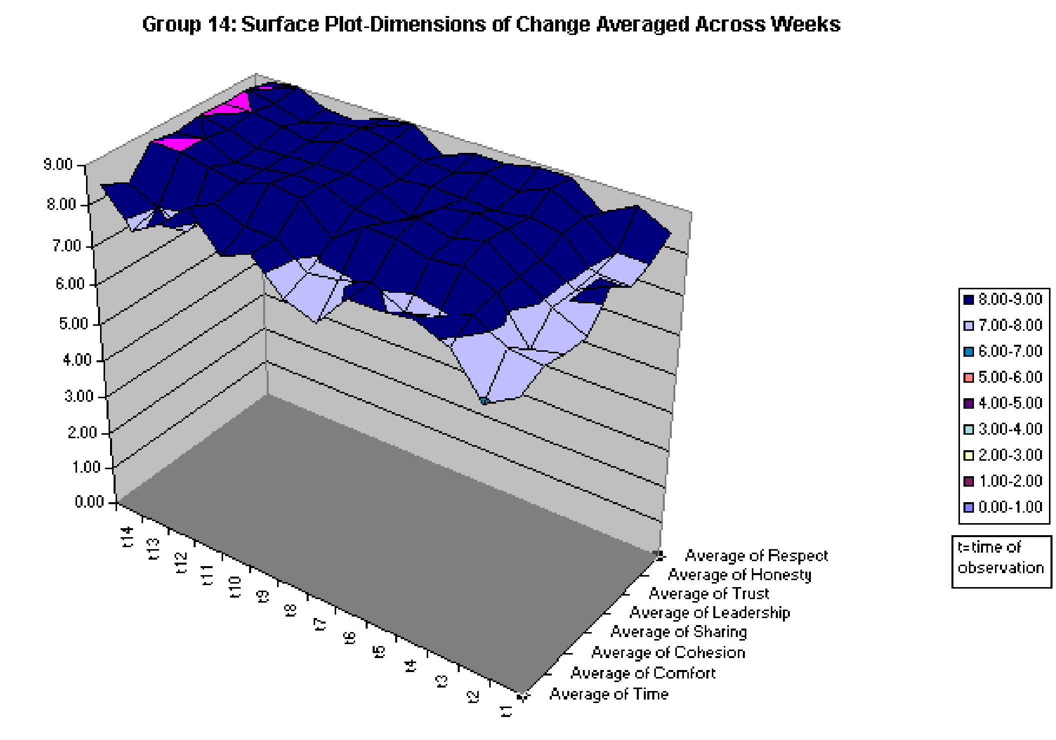


Figure 148. Group 14 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

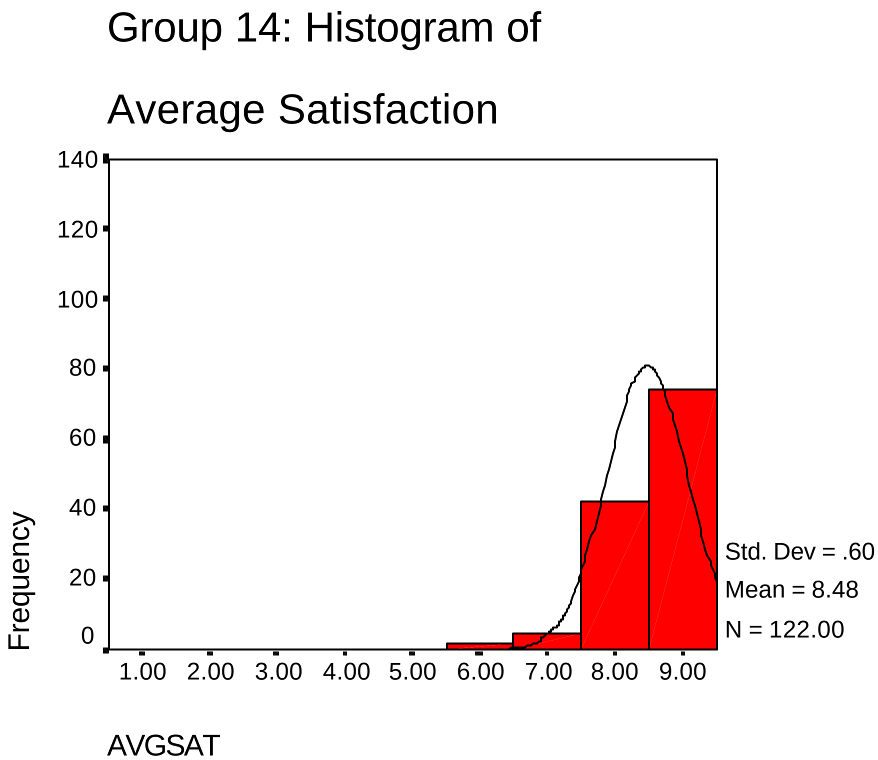


Figure 149. Group 14 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

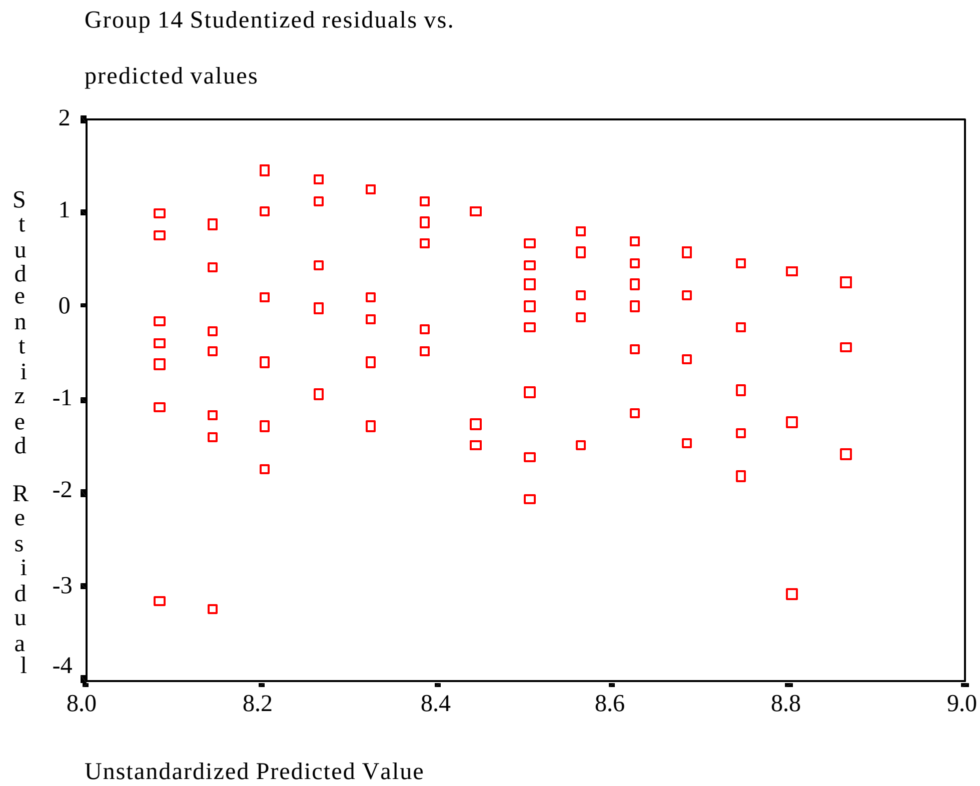


Figure 150. Group 14 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

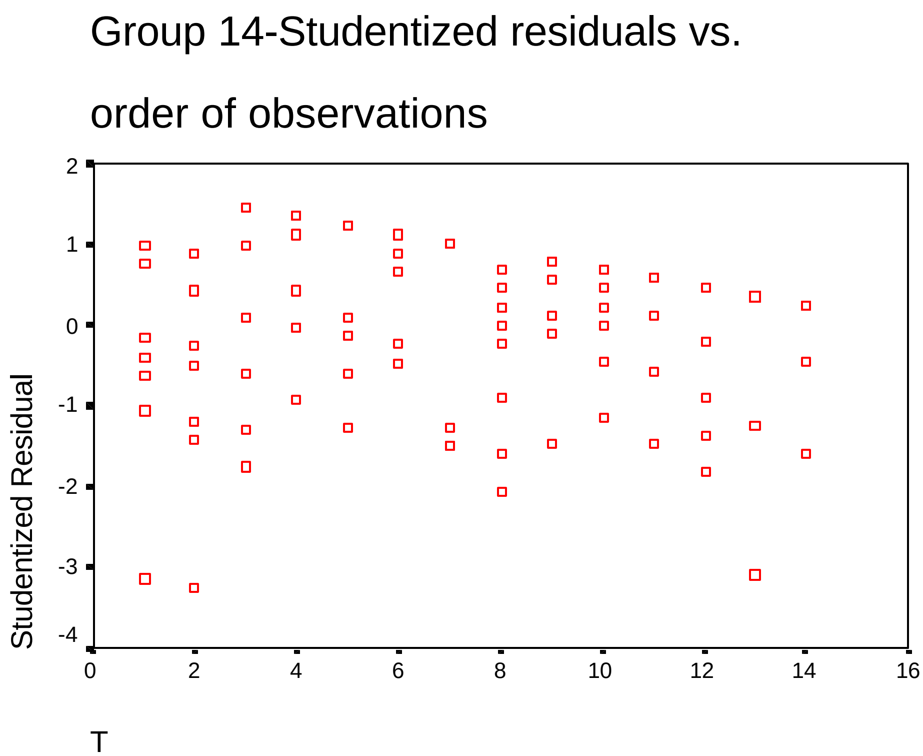


Figure 151. Group 14 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

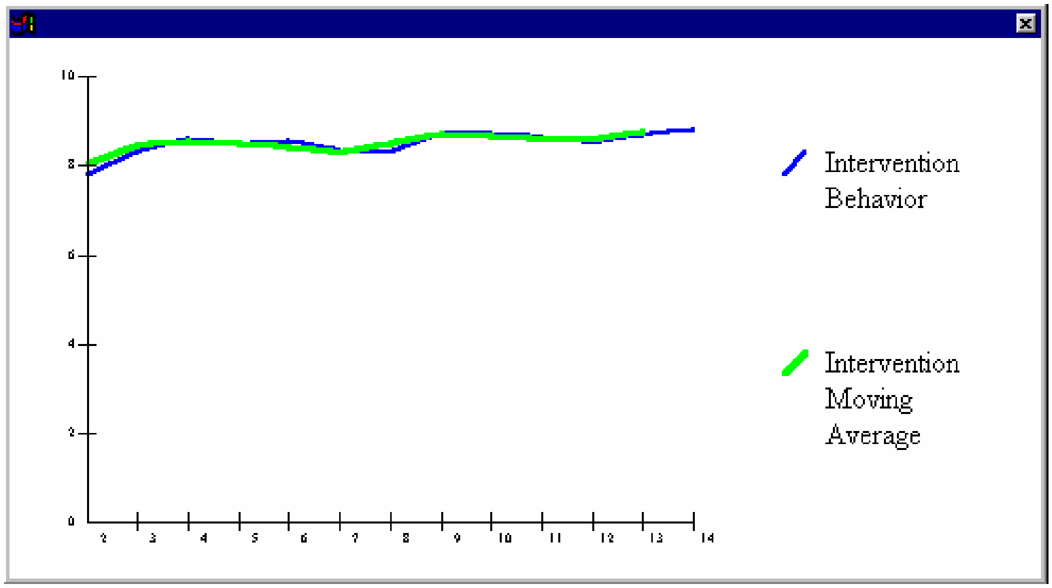


Figure 152. Group 14 (Singwin)-Moving average line: The intervention phase of group measurement.

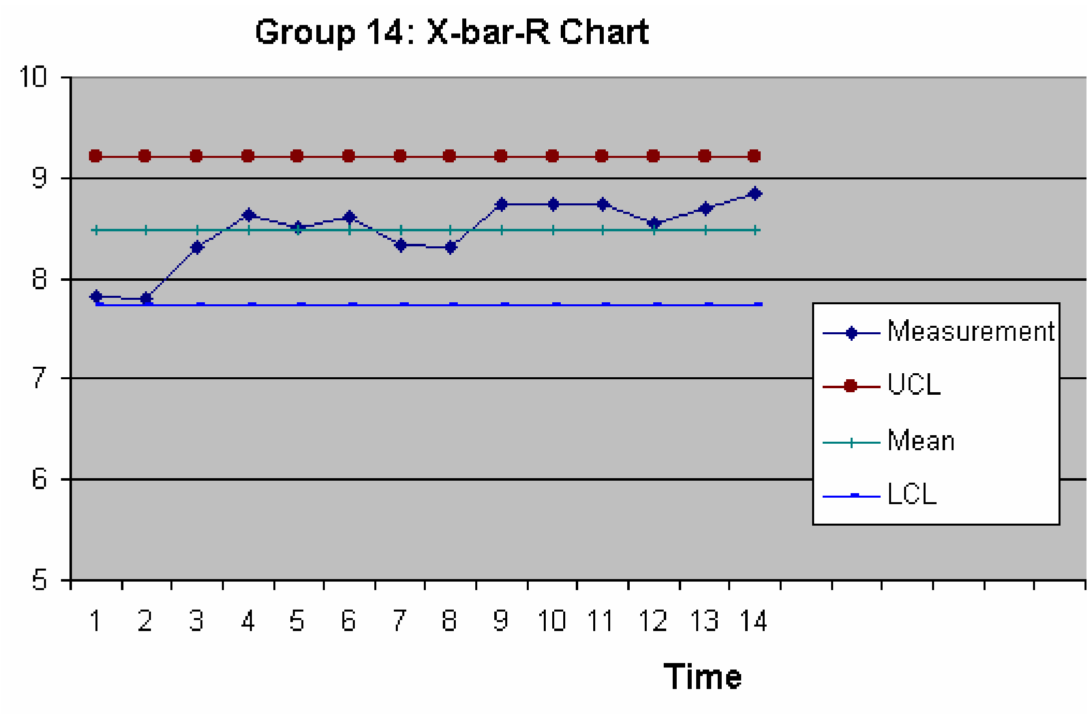


Figure 153. Group 14 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

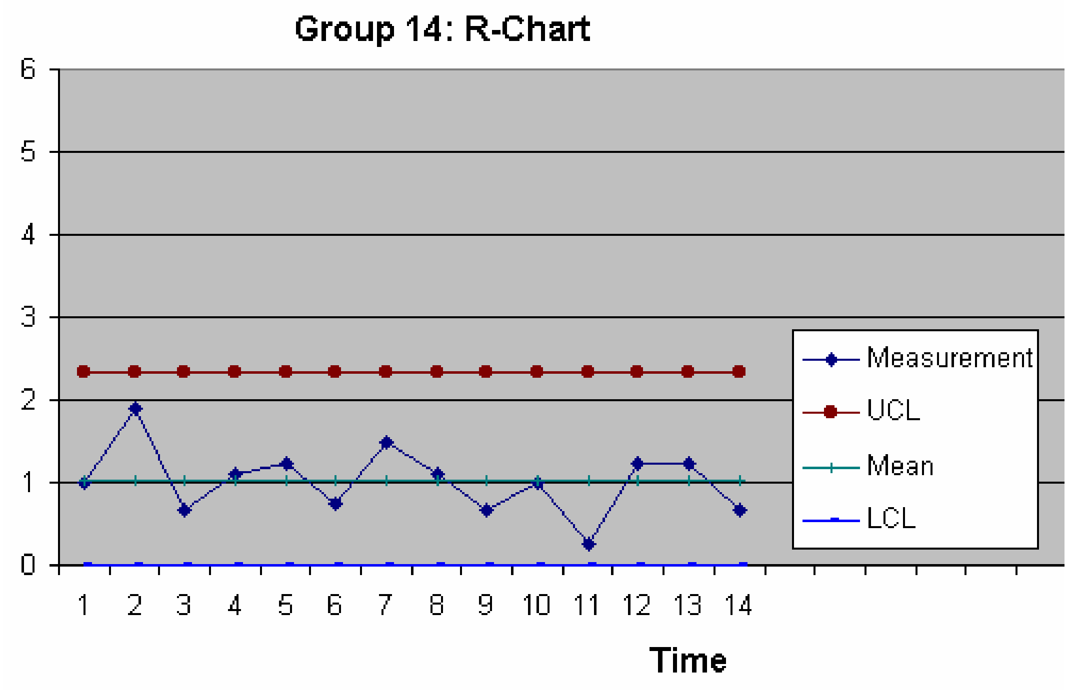


Figure 154. Group 14 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

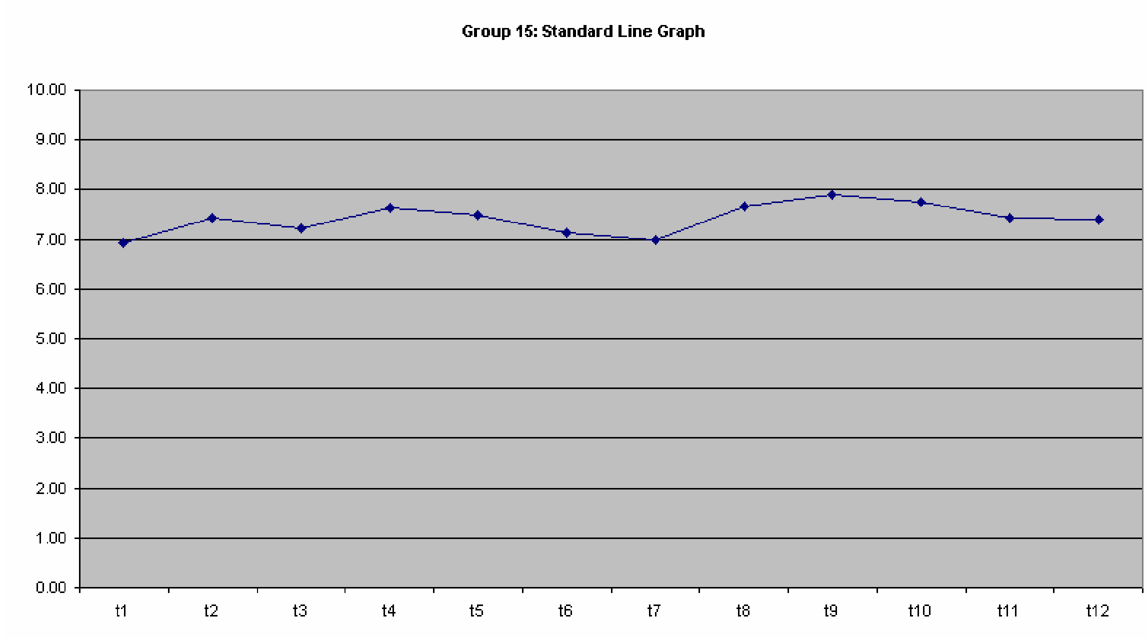


Figure 155. Group 15 (Excel)-Standard line graph: Average satisfaction across weeks.

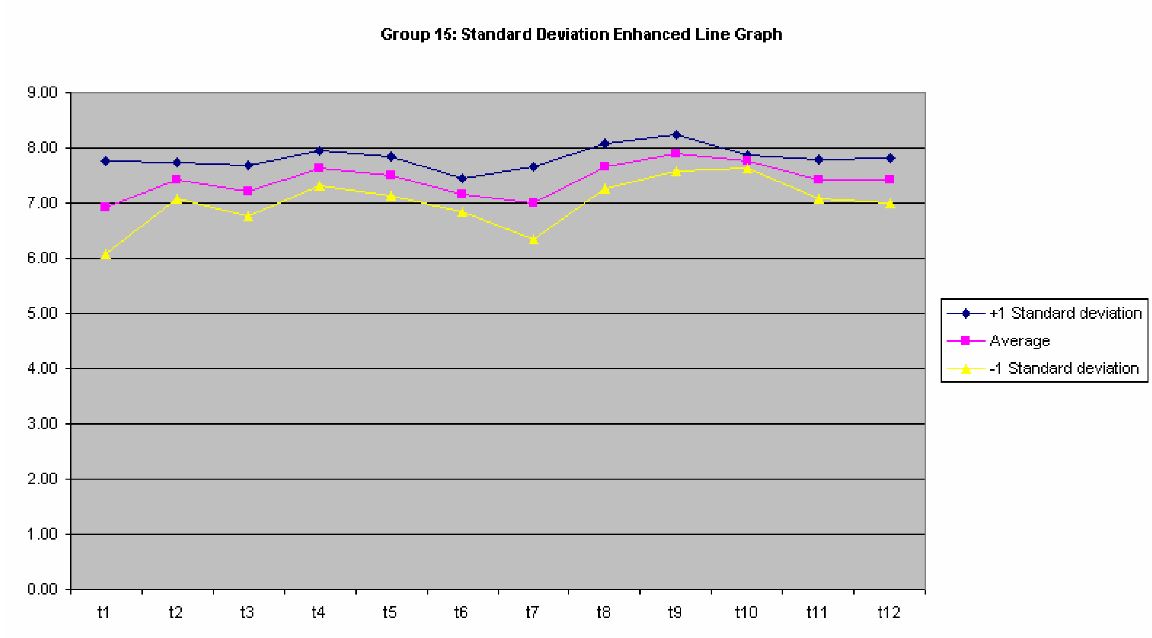


Figure 156. Group 15 (Excel)-Standard deviation enhanced line graph (SDELG): Concordance and variation of group satisfaction across weeks.

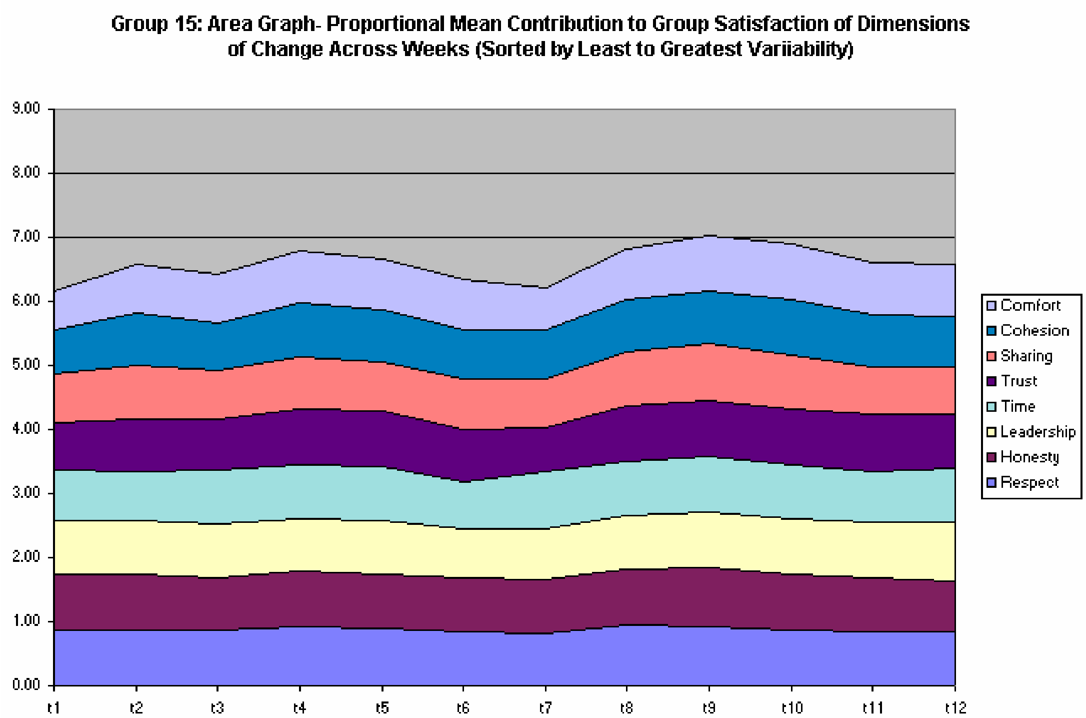


Figure 157. Group 15 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

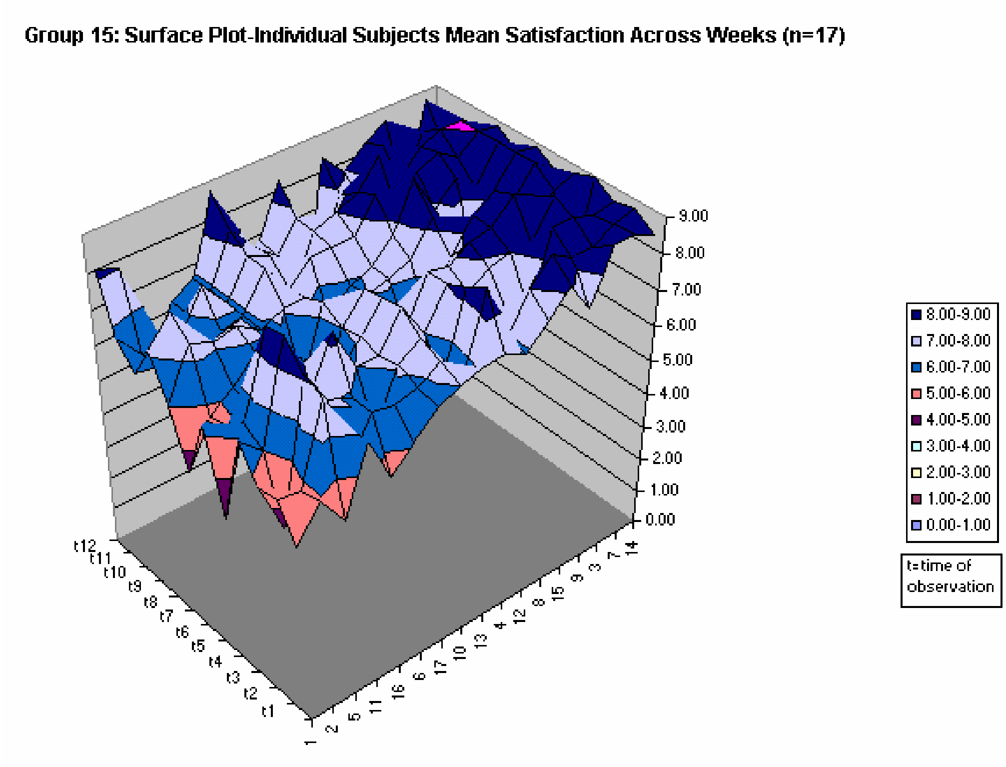


Figure 158. Group 15 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

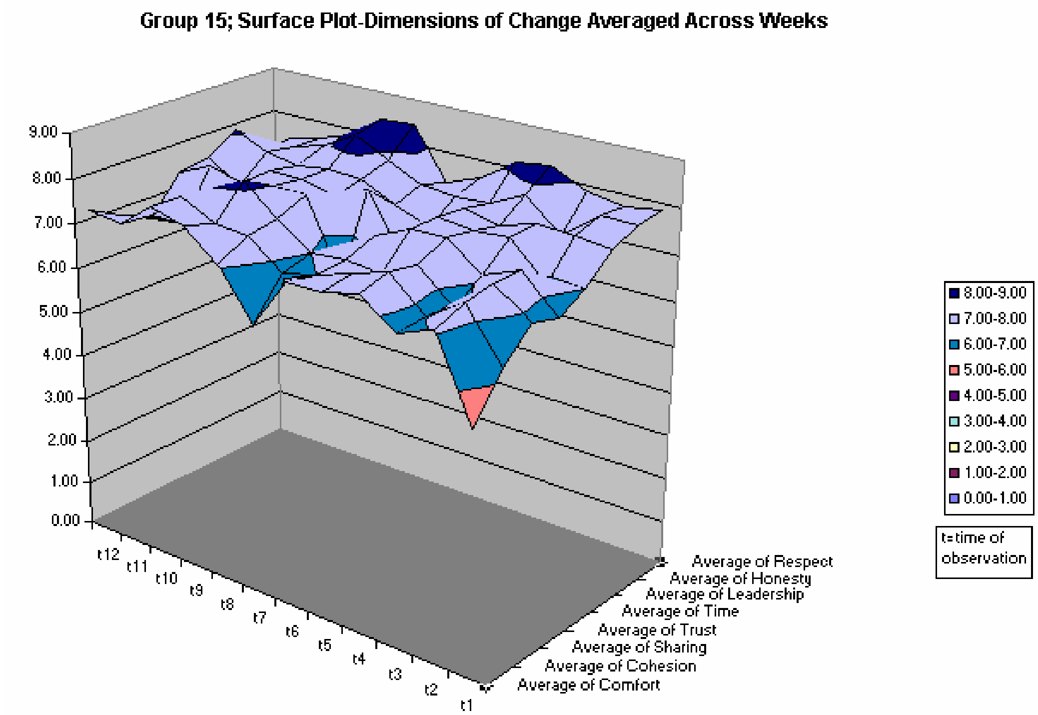


Figure 159. Group 15 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

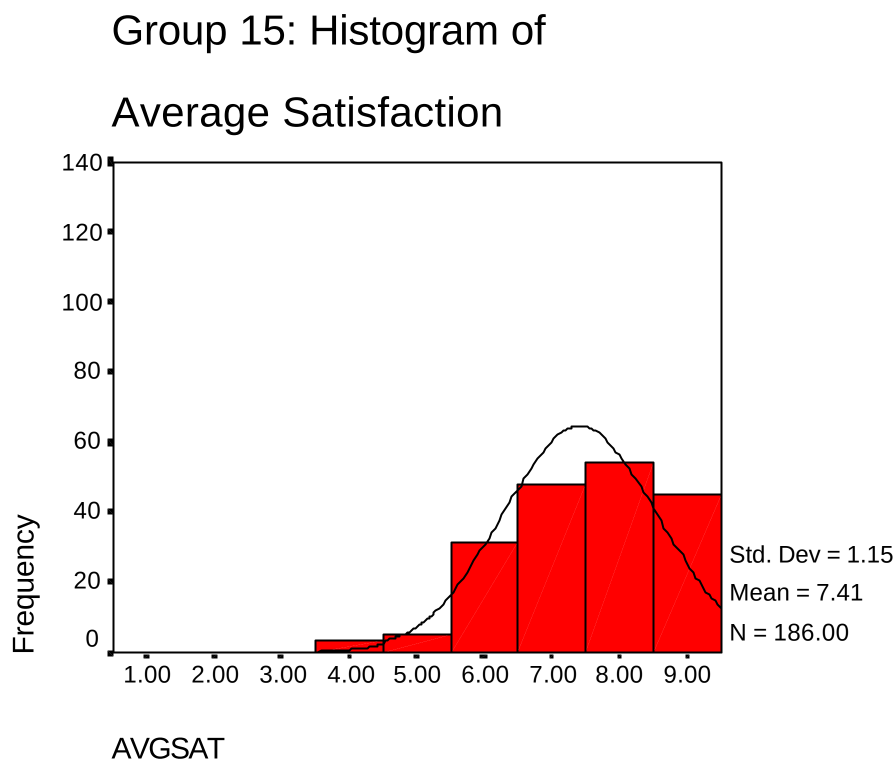


Figure 160. Group 15 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

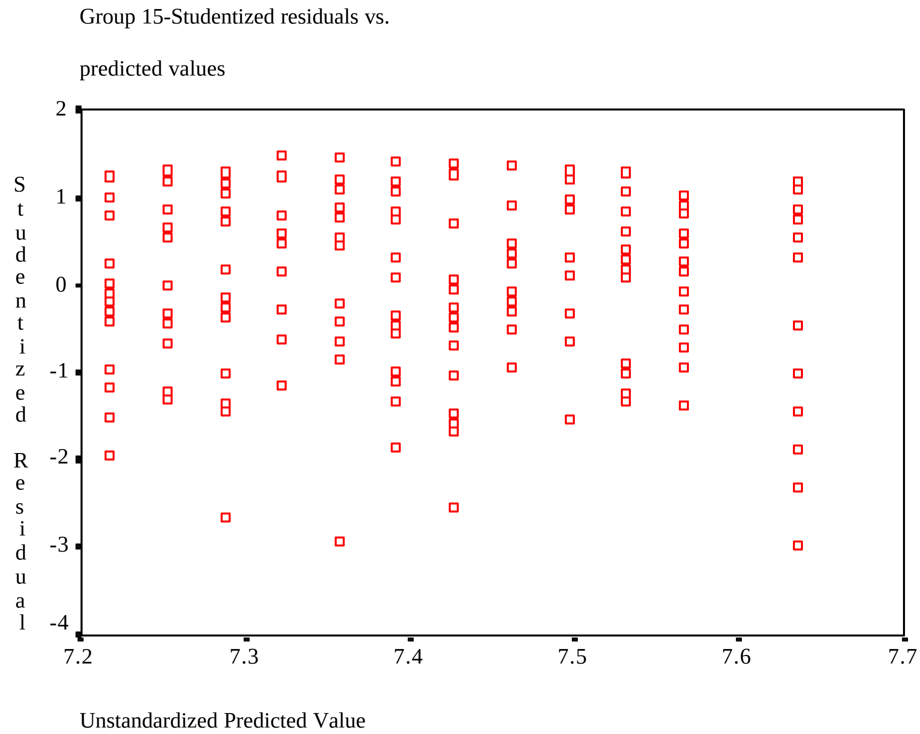
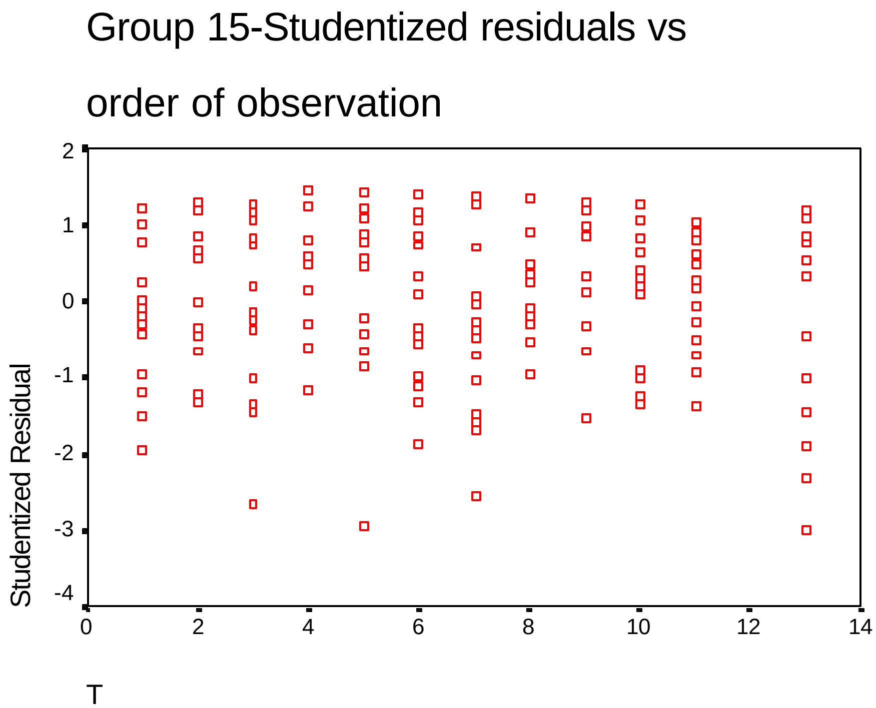


Figure 161. Group 15 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.



<u>Figure 162.</u> Group 15 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

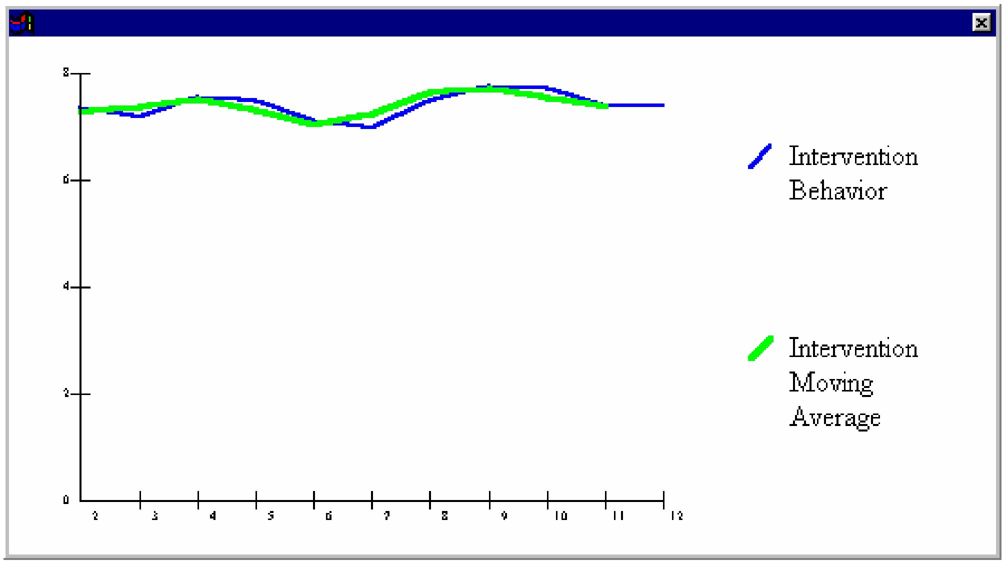


Figure 163. Group 15 (Singwin)-Moving average line: The intervention phase of group measurement.

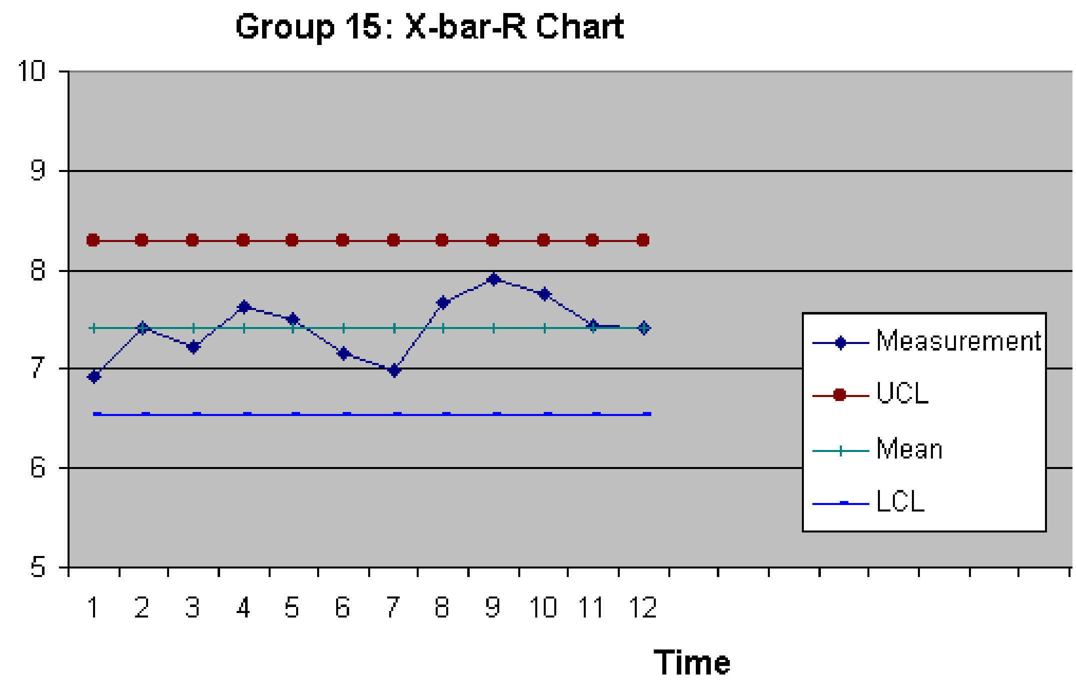


Figure 164. Group 15 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

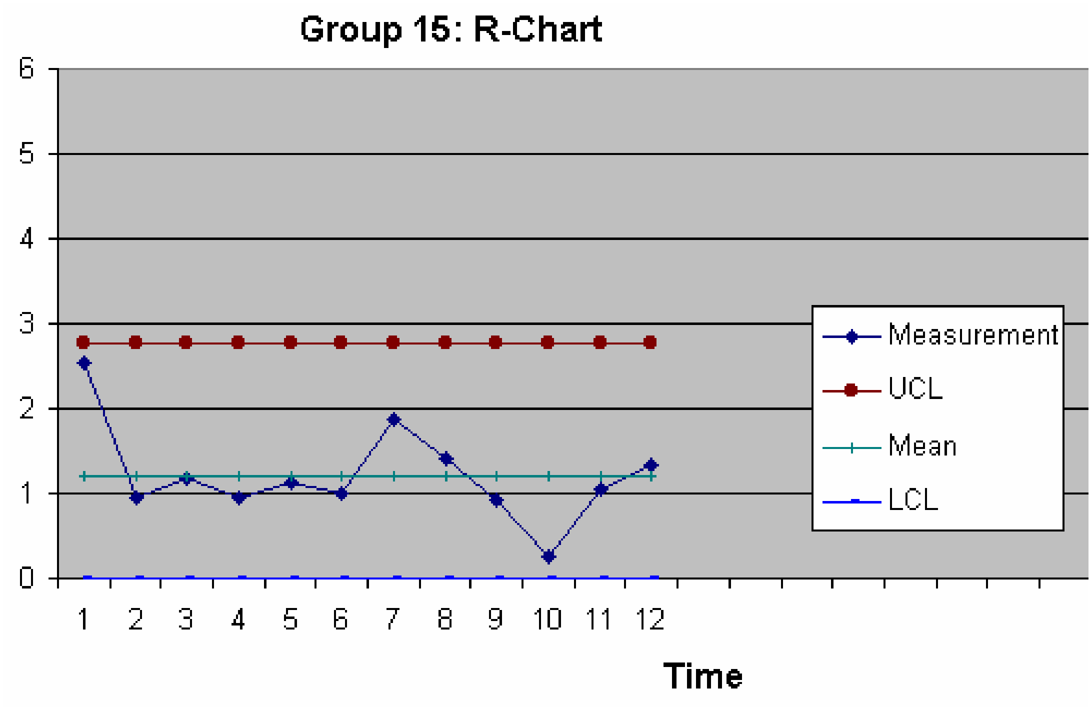


Figure 165. Group 15 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

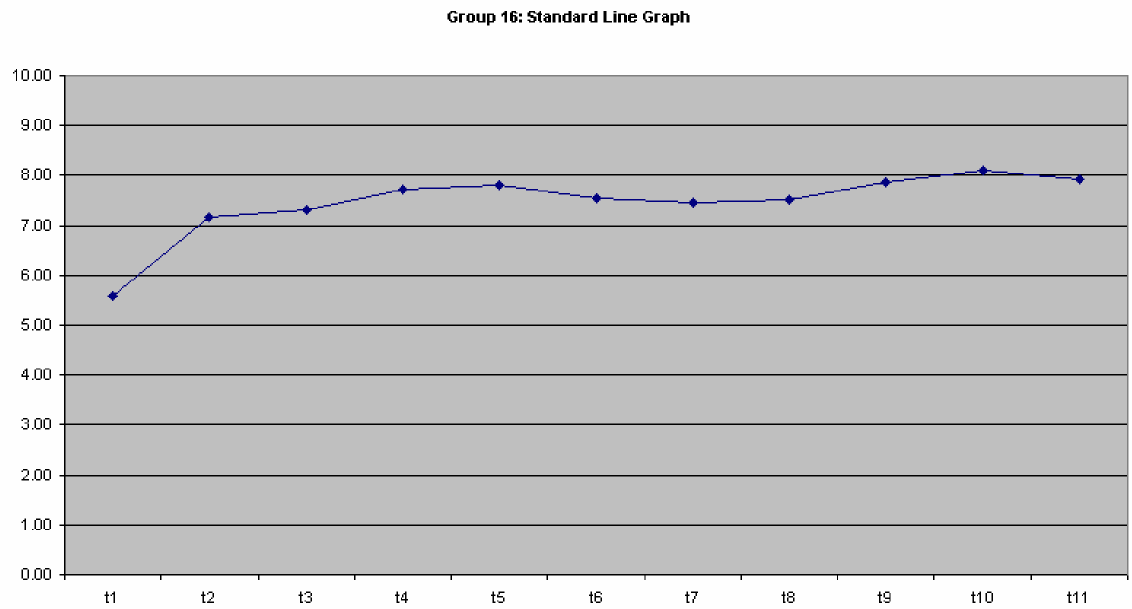


Figure 166. Group 16 (Excel)-Standard line graph: Average satisfaction across weeks.

Figure 167. Group 16 (Excel)-Standard deviation enhanced line graph (SDELG):

Concordance and variation of group satisfaction across weeks.

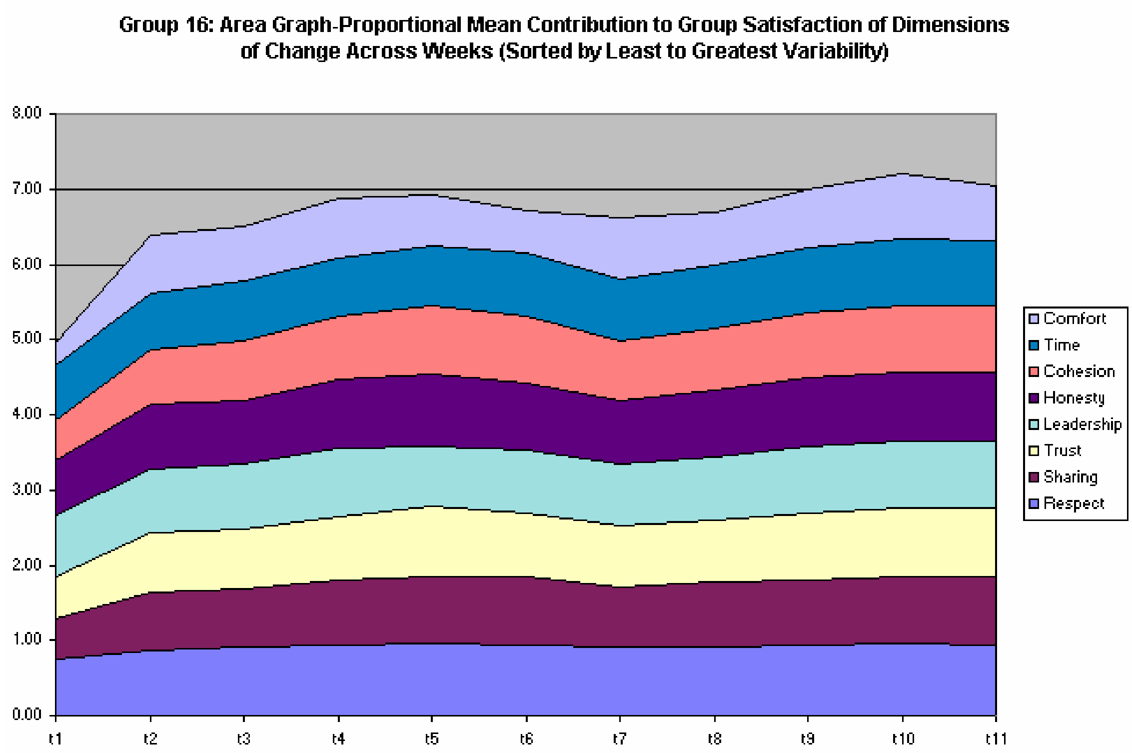


Figure 168. Group 16 (Excel)-Area graph: Proportional contribution of dimensions of change across weeks.

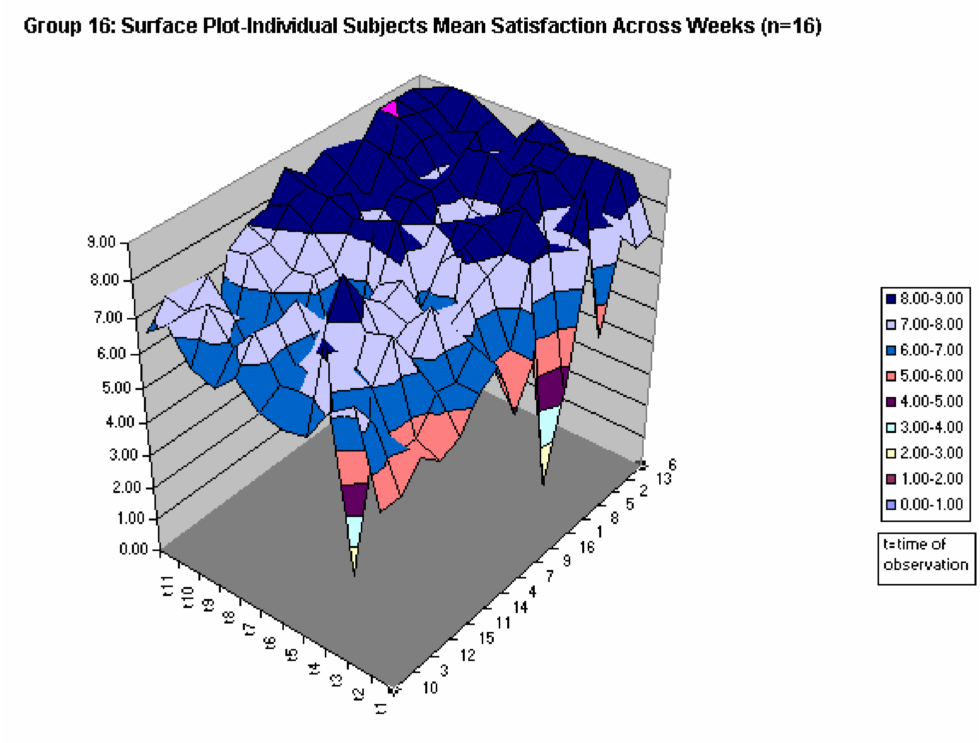


Figure 169. Group 16 (Excel)-Three dimensional surface plot (a): Individuals average satisfaction across weeks.

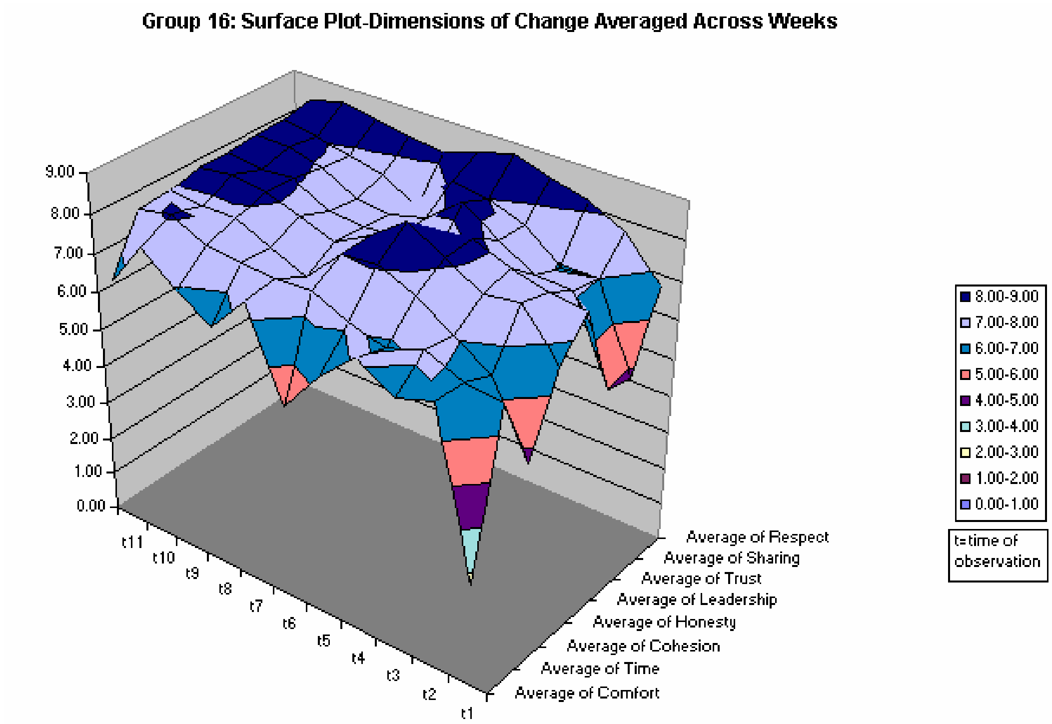


Figure 170. Group 16 (Excel)-Three dimensional surface plot (b): Dimensions of change averaged across weeks.

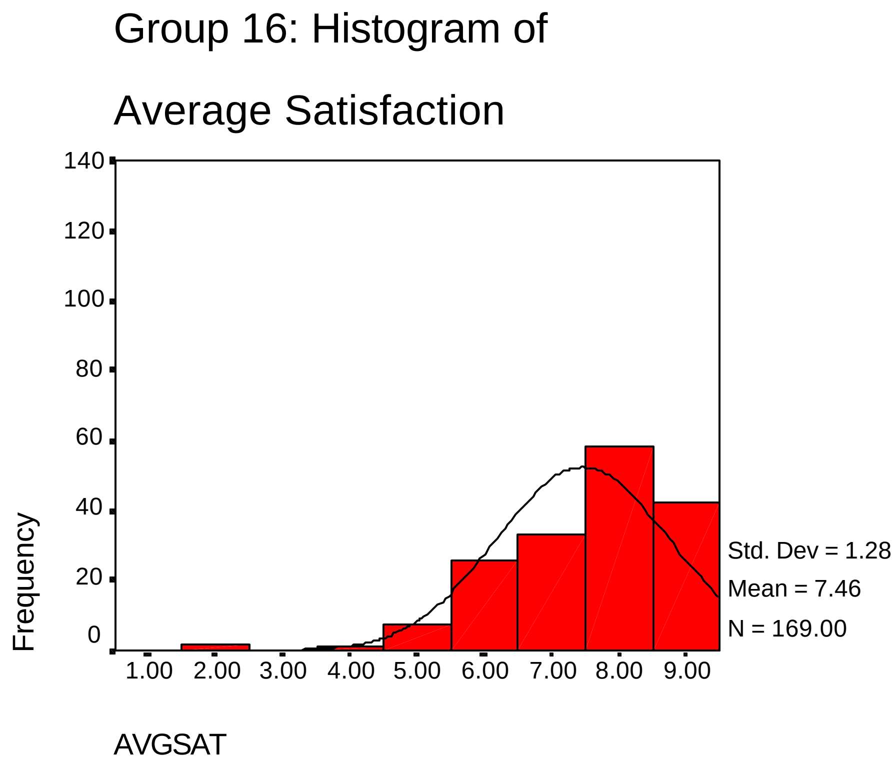


Figure 171. Group 16 (SPSS)-Histogram: Distribution of frequency of average satisfaction.

Figure 172. Group 16 (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

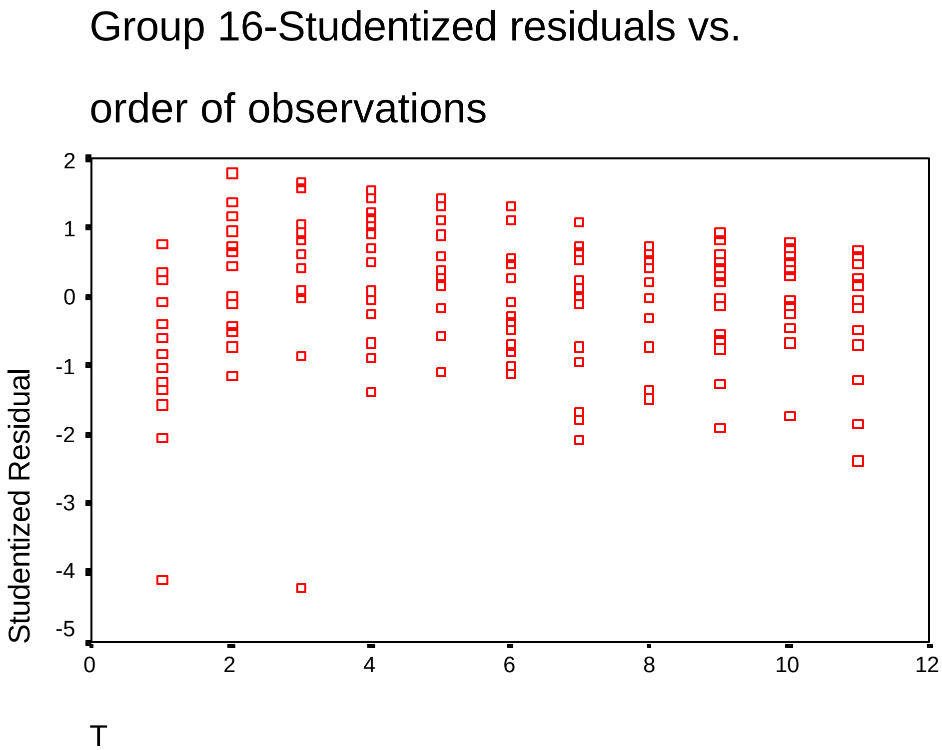


Figure 173. Group 16 (SPSS)-Scatterplot: Studentized residuals versus order of observations.

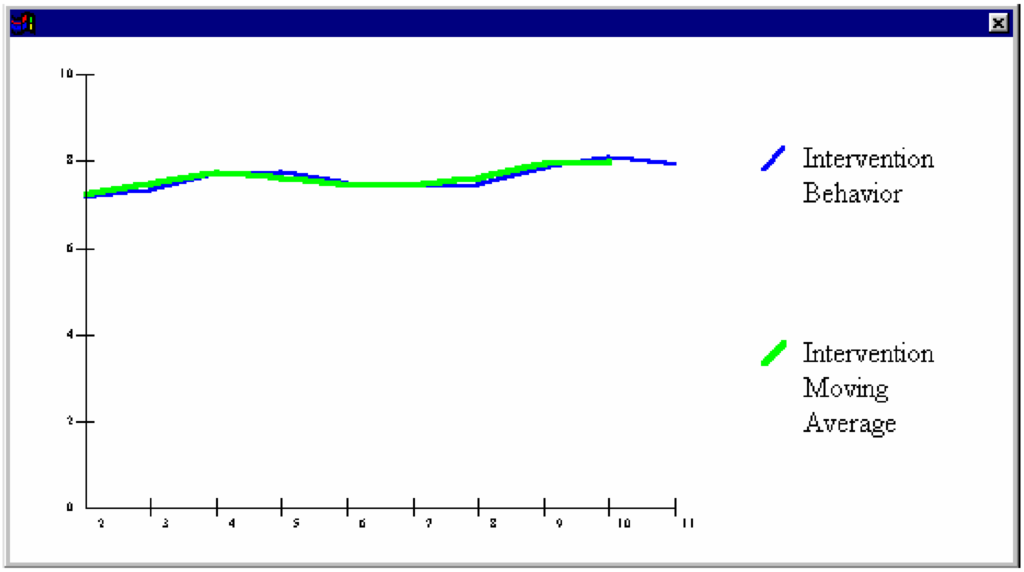


Figure 174. Group 16 (Singwin)-Moving average line: The intervention phase of group measurement.

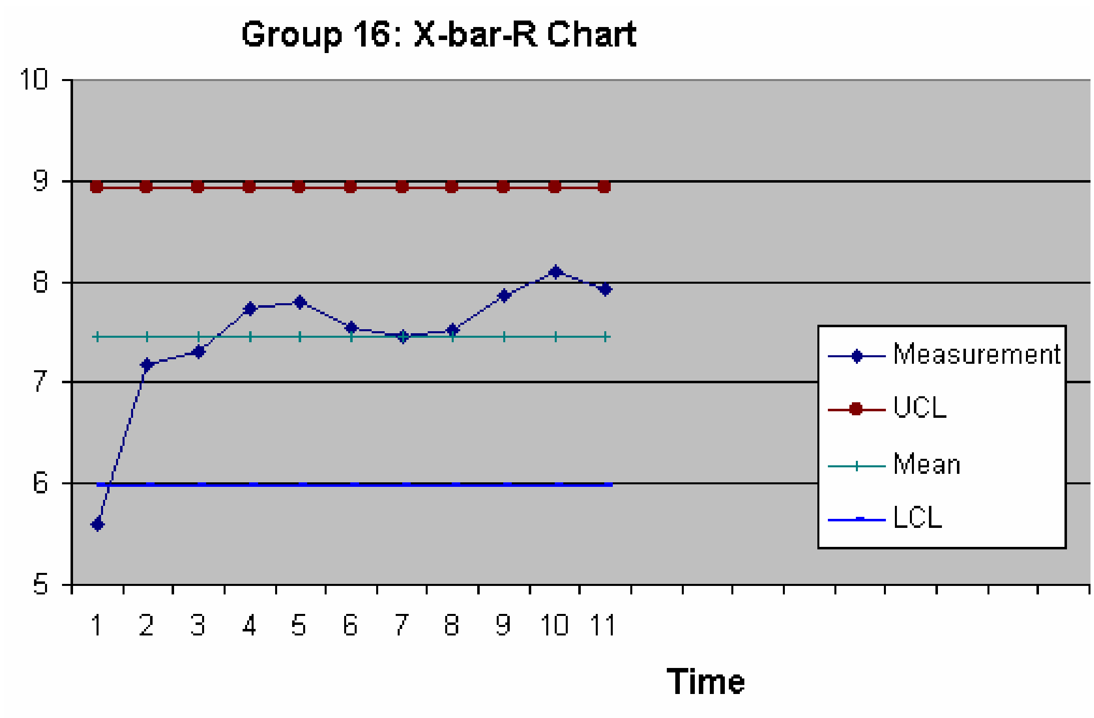


Figure 175. Group 16 (Excel add-on)-Statistical process control (SPC) chart: X-Bar–R chart.

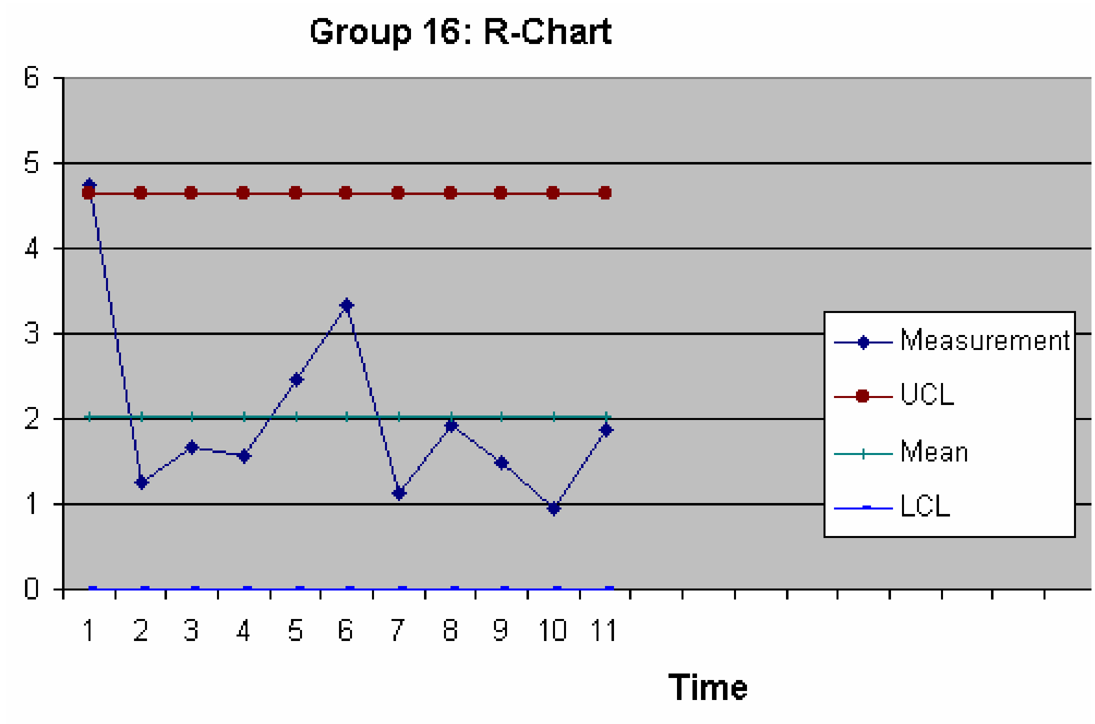


Figure 176. Group 16 (Excel add-on)-Statistical process control (SPC) chart: R-chart.

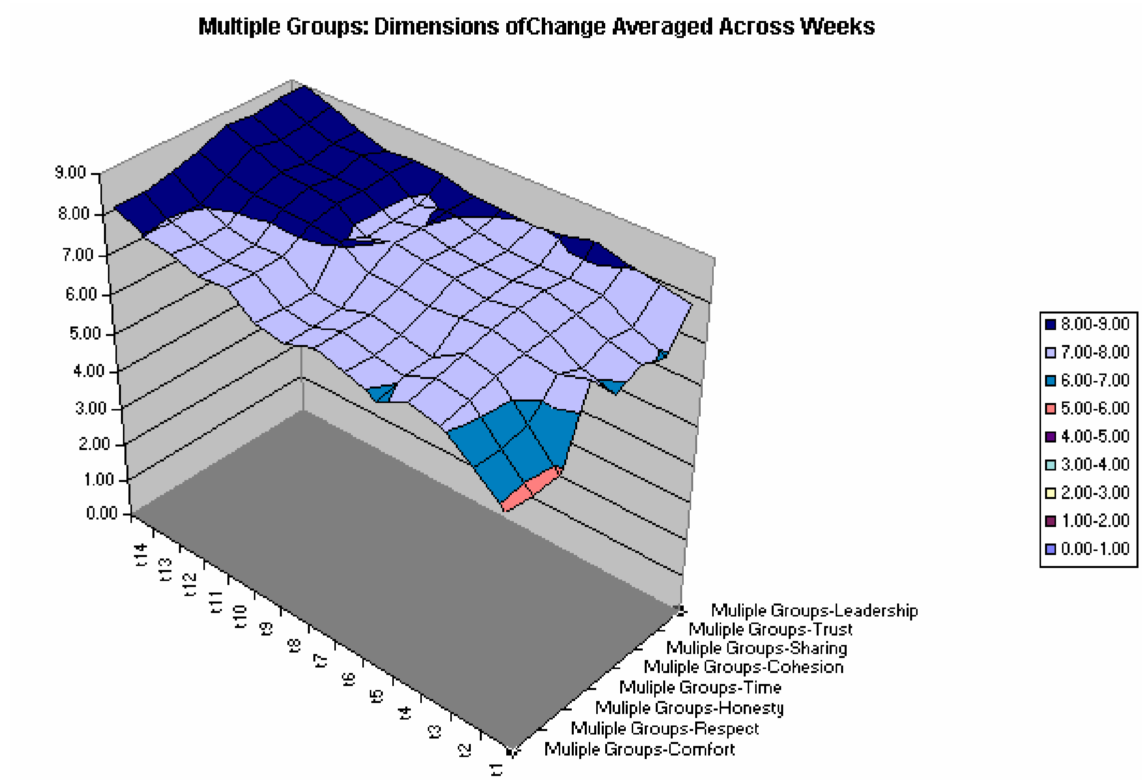


Figure 177. Multiple Groups (Excel)-Three dimensional surface plot: Dimensions of change.

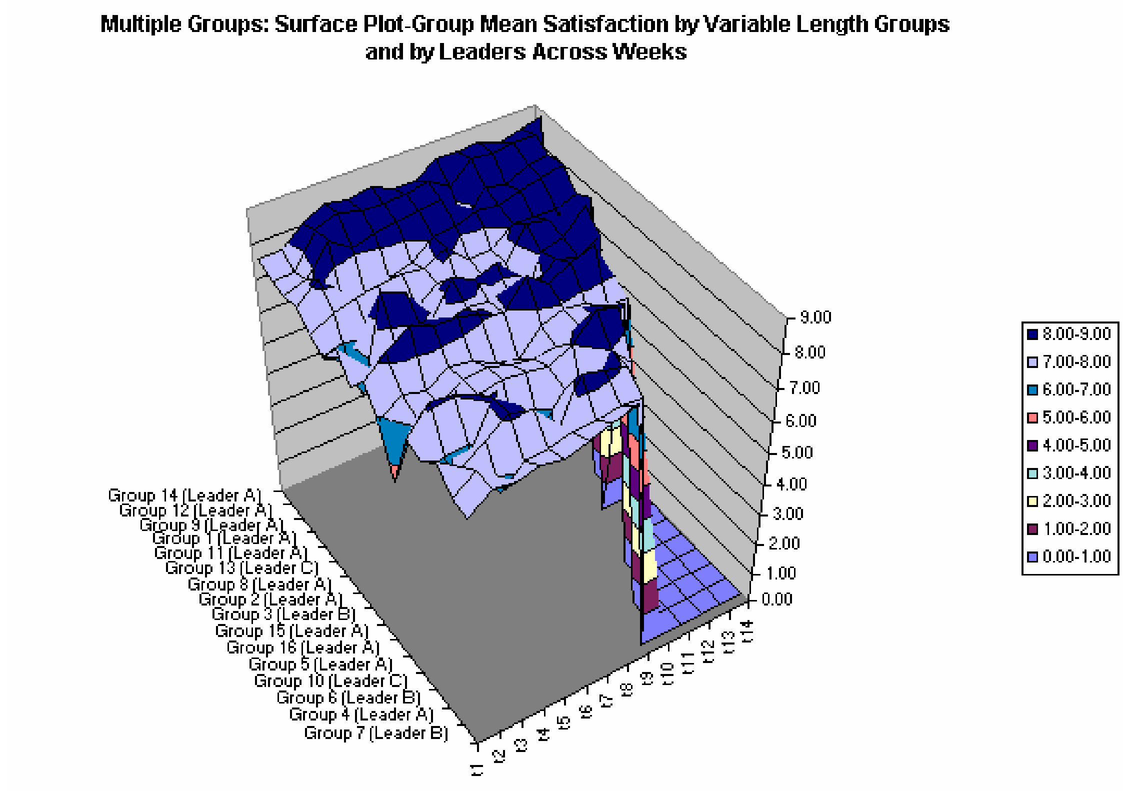


Figure 178. Multiple Groups (Excel)-Three dimensional surface plot: Group satisfaction by group leaders.

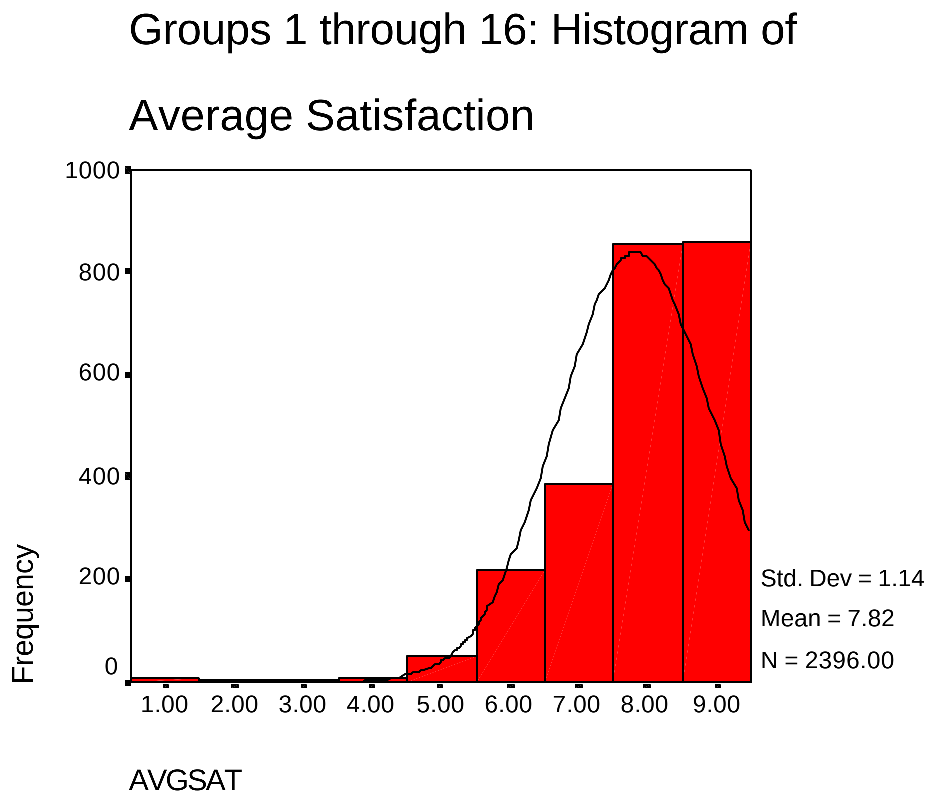
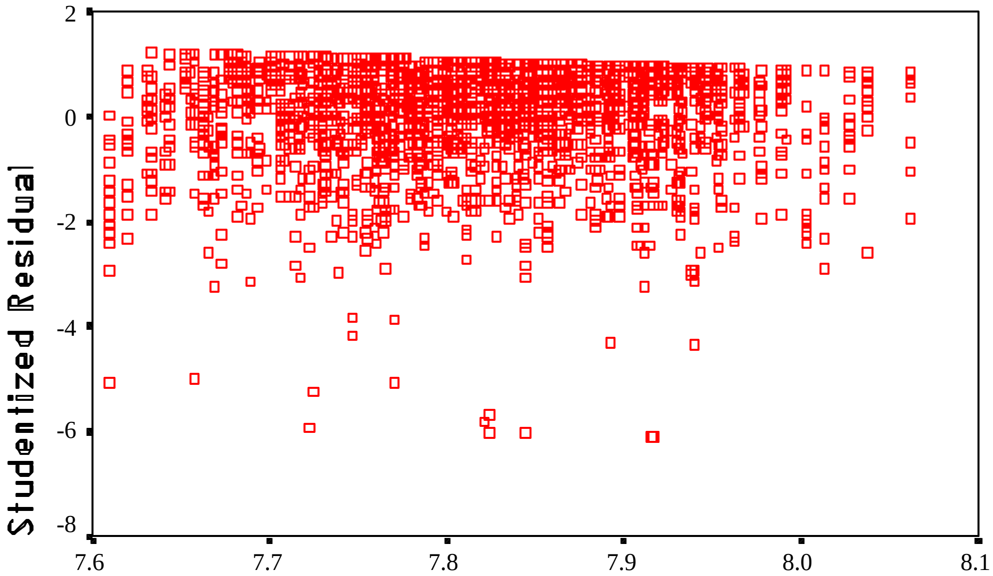


Figure 179. Multiple Groups: Histogram- Distribution of frequency of average satisfaction.

Multiple Groups-(1-16): Studentized residuals vs.

predicted values



Unstandardized Predicted Value

Figure 180. Multiple Groups (SPSS)-Scatterplot: Predicted and observed group satisfaction values.

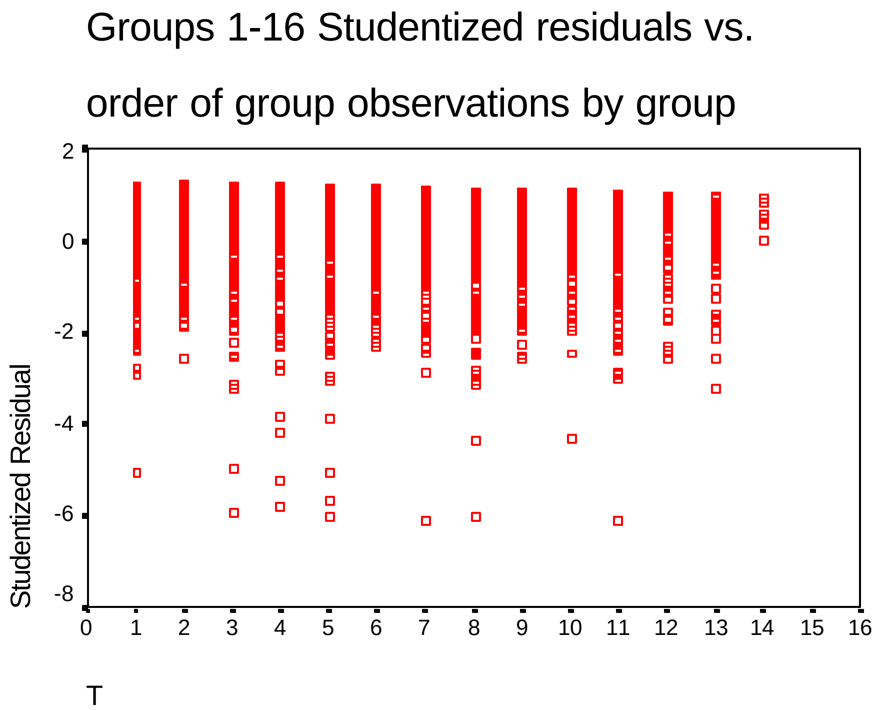


Figure 181 . Multiple Groups (SPSS)-Scatterplot: Studentized residuals versus order of observations.

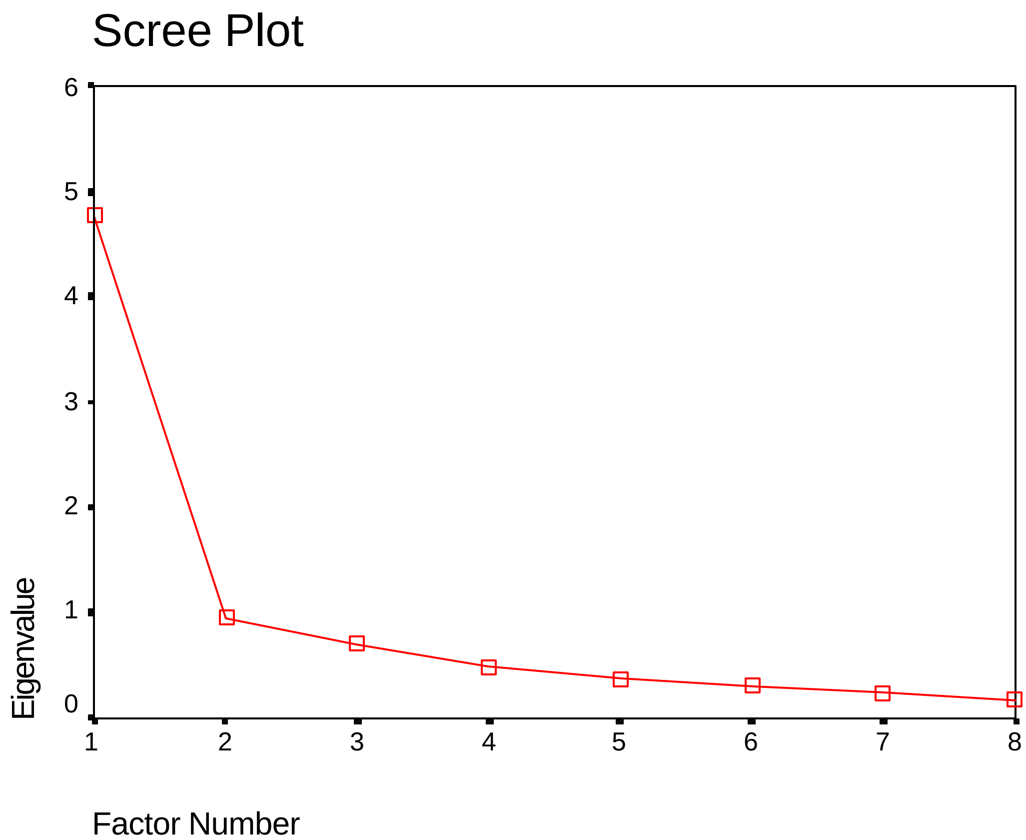


Figure 182. Scree Plot-Factor loading for all survey items on the Group Satisfaction survey in the first survey administration of all groups.

Vita

Randall E. Basham was born in Charleston, West Virginia, though he resided in the rural Appalachian coalmining town of Shrewsbury, West Virginia with his grandparents for much of his childhood. Through a series of relocations he attended and completed high school at Stonewall Jackson High School in Charleston, West Virginia in 1972. He supported himself in high school and college through a series of full time employments in hospitals until completion of his undergraduate degree in 1977 at West Liberty State College in West Liberty, West Virginia where he obtained his Bachelor of Arts degree in Psychology and Sociology. Physicians and a medical Social Worker often served as early role models and mentors.

He has been involved in rescue services and lifesaving in four major regional floods. He was on duty during the devastating Labor Day Flood of Wheeling Hospital in Wheeling, West Virginia in 1975 when 200 patients were evacuated in five hours following a flash flood and total loss of life support. He attended West Virginia University in Morgantown, West Virginia where he completed his Master of Social Work degree in 1981 with concentrations in health and mental health social work.

He was then employed for 19 years in the public and private mental health service sector in Southeast Ohio, northern West Virginia, and western Pennsylvania. His experiences have included chairing a Professional Advisory Board, coordinating specialty mental health treatment clinics, consultation services for skilled nursing facilities, home health services, and behavioral health care, a private practice and numerous community, professional and media appearances.

He also began his academic career serving as adjunct faculty and course instructor at Franciscan University of Steubenville, Ohio University: Eastern Campus, St. Clairsville, Ohio, Jefferson Community College of Steubenville, Ohio, The University of Tennessee, Knoxville, Tennessee and Pellissippi State Technical Community College of Knoxville, Tennessee. Course instruction levels have included adult community education, undergraduate, graduate, and post-graduate education. He has supervised Social Work interns for Ohio State University, The University of Pittsburgh, West Virginia University, West Liberty State College, and Counseling interns for Franciscan University of Steubenville Ohio.

He then entered academia in 1998 and attended The College of Social Work at The University of Tennessee, Knoxville, Tennessee to pursue doctoral education in Social Work. He has been focused on developing practice relevant research or research methods in the support of practice needs as a line of scientific inquiry. He completed his doctorate in 2002.