Analysis of the Efficacy of an Intervention to Improve Parent-Adolescent Problem Solving

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Abstract

We conducted a two-group longitudinal partially nested randomized controlled trial to examine
whether young adolescent youth-parent dyads participating in Mission Possible: Parents and Kids
Who Listen, in contrast to a comparison group, would demonstrate improved problem solving
skill. The intervention is based on the Circumplex Model and Social Problem Solving Theory. The
Circumplex Model posits that families who are balanced, that is characterized by high cohesion
and flexibility and open communication, function best. Social Problem Solving Theory informs
the process and skills of problem solving. The Conditional Latent Growth Modeling analysis
revealed no statistically significant differences in problem solving among the final sample of 127
dyads in the intervention and comparison groups. Analyses of effect sizes indicated large
magnitude group effects for selected scales for youth and dyads portraying a potential for efficacy
and identifying for whom the intervention may be efficacious if study limitations and lessons
learned were addressed.

Keywords

parent child communication; problem solving skill; conflict resolution; family theory

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Parents and young adolescents alike express apprehension about the developmental stage of
adolescence. Parents anticipate childrearing challenges and youths anticipate myriad
adjustments (Eisenberg et al., 2008). Adolescents' many physical, socio-emotional, and
cognitive changes contribute to the normative struggles that families face as children expect
and strive for autonomy (Viner et al., 2012). At the same time, parents seek to grant
autonomy with authority, warmth, discipline, and support (Van Doorn, Branje, & Meeus,
2011). It is well documented that as youth develop into adolescence, conflicts with parents

increase. Collins and Laursen (2004) stated that bickering and quarreling over everyday issues is common for parents and their adolescents. De Goede, Branje, and Meeus (2009) reported that not only does the frequency of disagreements, anger, and tension with parents increase in early adolescence, intensity increases in middle adolescence. They further espouse that problem solving involving an understanding of the other's position and using constructive reasoning to work out compromise is needed. However, adolescents and their parents report they do not possess the problem solving skill to manage the increased conflict and may turn to healthcare providers for advice (Koo, Rose, Bhaskar, & Walker, 2012).

Mission Possible: Parents and Kids Who Listen (MP; Riesch et al., 1993) was developed for parents and young adolescents and adapted for parents and pre-adolescents (Riesch, Anderson, & Krueger, 2006) as a universal prevention and behavioral training program to promote communication. A universal intervention is one that is aimed at all members of the young adolescent-parent population (Small & Memmo, 2004). The purpose of this study is to examine the efficacy of MP for promoting an important aspect of communication, the ability of youth and parents to solve problems together.

Theoretical Background

The content of MP is based on theoretical insights from the Circumplex Model of Marital and Family Systems (Olson, 1993) and the Social Problem-Solving Theory (D'Zurilla & Nezu, 1999). Consistent with the Circumplex Model, MP works toward a youth-parent relationship that is characterized by open communication and high adaptability (flexibility) and cohesion. According to Olson (1993), the model categorizes families into typologies of balanced, mid-range, and extreme (unbalanced) based upon the dimensions of flexibility and cohesion. Flexibility is the capacity for change in the leadership, roles, and relationship rules in response to situational and developmental demands and is on a continuum from very flexible to rigid. Cohesion is the emotional bonding family members have toward one another and is on a continuum from very connected to disengaged. Families who are high on both flexibility and cohesion are balanced, those who are moderate or high on one dimension but low on the other are mid-range, and those who are low on both dimensions are unbalanced or extreme (Olson, 1993). Family type is considered to be a trait and as such non-modifiable (Olson, 1993). Olson and Gorall (2003) indicated that some families may function well at the rigid or disengaged levels but not over the long term unless the members are satisfied. Based on theory and literature that high cohesion families had less negative communication (McGuigan, Vuchinich, & Tang, 2014), we expected family type to be an important covariate in problem solving.

Communication is the expression of ideas and feelings assertively but inoffensively and the reception of ideas expressed by others attentively and accurately (Robin, 1979). Clear and congruent messages, empathy, reflective listening, supportive statements, and effective problem solving typify open communication. Open communication enables family members to share their changing needs and preferences thus adapting while staying cohesive (Olson, 1993).

Problem solving is an important aspect of communication because conflicts increase in families of pre and young adolescents (McBride, Paikoff, & Holmbeck, 2003). D'Zurilla, Nezu, and Maydeu-Olivares (2004) defined problem solving as the modifiable, learned, cognitive-behavioral process by which a dyad identifies and implements effective solutions for a specific problem. MP content included cognitive and behavioral strategies from the Social Problem Solving Theory (D'Zurilla & Nezu, 1999).

Investigators have reported that differing parent-child communication patterns are found among boys and girls. In a recent review, Racz and McMahon (2011) documented that girls, in contrast to boys during young adolescence, experienced higher levels of knowledge about what their parents expected of them and had fewer secrets about leisure time activities. In later adolescence, girls experienced a better quality relationship with their parents and more reliance on them for help and support compared to boys. Boys tended to be independent and sought out conversations about hobbies and sports while girls tended to be relationship-oriented, interdependent, and to seek deeper, nurturing conversations (Gorrese & Ruggieri, 2012). Girls were reported to be more skilled and interpersonally sensitive than boys (Fivush, Brotman, Buckner, & Goodman, 2004). Considering the gender of parents and youth, when the topic was sexual activity, mothers tended to communicate more than fathers with young adolescents of either gender, particularly about feelings. However, fathers had more conversations with sons than daughters on this topic (Anderson et al., 2011).

Specific to problem solving, the literature on youth gender is inconsistent. Studies of problem solving focus upon the strategies used by parents (Van Doorn et al., 2011). Youth were more likely to engage in problem solving if they chose the topic and the process was with their mother (Huff, Werner-Wilson, & Kimberly, 2014). During problem solving tasks, girls used cooperative strategies whereas boys used directed and controlled speech likely the result of being spoken to in this manner by adults (Leaper, Anderson, & Sanders, 1998). Thus, youth gender may be an important covariate in problem solving.

Purpose

The purpose of this study was to examine MP for efficacy in promoting youth-parent problem solving skill. The intent of the paper is to (a) present the results of a study testing the hypothesis that youth and parents who participated in MP will show improved problem solving skill as demonstrated by the higher rate of change on observed indicators of problem solving when compared with youth and parents in the comparison group over time and adjusting for youth gender and family type; (b) examine the potential for efficacy of MP for problem solving skill; and (c) articulate lessons learned from this randomized control trial.

Method

Design

This study was a two-group (intervention and comparison) partially nested randomized control trial. Elementary schools, randomly assigned to intervention and comparison groups in two cities, served as recruitment sites for youth-parent dyads. We proposed the partially nested randomized control trial design because we thought the dyads in the intervention

groups may know one another and as such their responses could demonstrate dependencies (Bauer, Sterba, & Hallfors, 2008). Intervention dyads attended MP for 6 consecutive weeks of two-hour per week communication skill building sessions and one booster session. Comparison dyads did not receive an intervention. All dyads in both groups were followed for three years and participated in five waves of in-home, computerized data collection at intake, 10 weeks, 8 months, and 1 and 2 years post-intake. A randomly selected sample of 50% of the dyads participated in a videotaped task to assess problem solving skill.

The study protocol was reviewed and approved by the University's Institutional Review Board and the External Research Review Committees of the collaborating school systems.

Sample Size, Eligibility, and Recruitment

Anticipating a similar reduction in anti-social problem solving behavior achieved in a prior quasi-experimental study (Riesch et al., 1993), we estimated that a sample size of 60 dyads in each condition would be sufficient ($1-\beta = .80$, $\alpha = .05$) for the problem solving task. The eligibility criteria at intake were that youth and adults (mother, father, other adult) were English-speaking and that youth were 10 years of age and in grade five. We chose 10 years of age and grade five because youth at this age and grade typically are at the precipice of puberty and are not yet experiencing the marked increases in conflicts with parents and the numerous developmental changes associated with puberty (Smetana, 2005; Viner et al., 2012). Exclusion criteria included mental or physical illness that precluded participation in data collection procedures or family plans to move from the metropolitan areas prior to study completion. Participants were recruited from elementary schools in Madison, WI and Chicago, IL.

Based on the number of fifth graders enrolled in elementary schools in both cities, partnering with 45 schools would result in a population of over 5,000 fifth graders. From a list of all elementary schools stratified for African American (> 60%) enrollment in both cities, 28 schools in Madison and 17 schools in Chicago were randomly selected, randomly assigned to the intervention or comparison condition, and then approached for agreement to serve as a recruitment site. In Madison, 26 schools agreed, in Chicago 5 schools agreed. Study invitations in US postage stamped-envelopes were provided to the school districts. The districts addressed and sent the invitations, including a letter from the appropriate school principal, to 4,711 fifth grade school children and their parents. Families responded directly to the study offices in each city by phone, email, or post card; were screened for eligibility by phone; and enrolled on study. The CONSORT diagram is displayed in Figure 1.

Of the 485 families who responded to the invitation, 406 (11%) agreed to be assessed for eligibility, 361 met eligibility criteria, and 302 were consented. Reasons for non-consent included the family would not or could not commit the time for participation (n = 49), child would not commit to participation though the parent wanted to (n = 4), an older sibling was already in the study (n = 2), or respondent said s/he would think about it and did not follow up or answer further attempts from the team (n = 4). Dyads from the intervention schools were allocated to MP.

Variables and their Measurement

Descriptive information was collected with a demographic form. The information included youth and parent gender, age, ethnicity, race, and parent partner status, education level, and income.

Problem Solving Skill included (a) problem definition, (b) generation of solutions, (c) decision making, and (d) solution implementation and verification (D'Zurilla & Nezu, 1999). Consistent with this definition, scales that measure individual and dyadic problem solving skill were used from the Iowa Family Interaction Rating Scales (IFIRS) (Melby & Conger, 2001). The scales (a) Solution Quantity, (b) Solution Quality, and (c) Negotiate/Compromise were consistent with problem definition and solution generation. These were individual scales, meaning youth and parents were rated as individuals. The scales (a) Agreement on Solution and (b) Implementation Commitment were consistent with decision making and solution implementation and verification. These were dyadic scales, meaning youth and parents were rated as a dyad.

The Solution Quantity scale measured the number of specific ideas about how to solve the problem. A solution was defined as a proposed means for reaching a goal that involved an action or change in behavior. Response choices were 1 "No solutions proposed" to 9 "More than 8 solutions proposed." The Solution Quality scale measured the degree to which solutions were reasonable, realistic, potentially beneficial, specific, feasible, contingent, non-exploitive, seriously offered, or achievable. Response choices were 1 "No solution proposed" to 9 "Solution showed a high level of all characteristics and a high level of development." The Negotiate/Compromise scale measured willingness to settle differences by mutual concessions. Response choices were 1 "Expressed no openness to hearing or considering the other's point of view" to 9 "Consistently showed a willingness to negotiate and compromise and displayed enthusiasm for trying out the other's ideas or solutions."

The Agreement on Solution scale measured the extent to which a dyad resolved and/or reached agreement on a solution to a problem. Response choices were 1 "No one proposed a solution to the problem" to 9 "Dyad agreed and seemed pleased or satisfied, or readily agreed with one solution (or a combination of solutions)." The Implementation Commitment measured the extent of a dyad's commitment to a plan to accomplish or carry out an agreed-upon solution. Response choices were 1" No one committed to a plan for implementing a solution, or no solution was proposed, or they elected to handle the problem as they always have" to 9 "Both agreed and seemed pleased with plan for implementing the solution."

The IFIRS is a macro-level observational coding system developed in 1989 to code behavioral processes and problem-solving interaction in families with children aged 2 through adulthood. It consists of individual (parent and youth), dyadic, and group level scales. IFIRS has undergone 5 revisions (Melby & Conger, 2001). The ratings for nearly all scales range from 1 "Not at all characteristic" to 9 "Mainly characteristic."

Prior studies have validated IFIRS Scales as sensitive to change and predictive of problem solving skill. Reuter and Conger (1995a, 1995b, 1998) documented that an individual's and a dyad's interaction style predicted their problem solving behavior, and that there was a

reciprocal relationship between a child's problem solving behavior and parental behavior. IFIRS ratings discriminated families who could effectively solve problems from those who could not (Reuter & Conger, 1992). Kosterman, Hawkins, Haggerty, Spoth, and Redmond (2001) reported statistically significant change post-intervention for parent, youth, and dyadic interactions. Pridham, Melby, Clark, and Brown (2010) reported the negotiate/compromise scale was sensitive to change over an eight month period among parents of premature infants. Since these IFIRS scales are single items, Cronbach Alpha reliability testing is not appropriate.

Family Type was assessed with the Family Adaptability and Cohesion Evaluation Scales III (FACES III), a 20-item, self-report instrument. An item example to measure adaptability is, "We shift household responsibilities from person to person." An example of an item to measure cohesion is, "Family members feel very close to each other." Response options range from 1 "Almost never" to 5 "Almost always." Participants answer each item twice, first to assess current and then to assess ideal family system conditions. FACES III has been used in over 500 studies and has demonstrated validity and reliability for summative as well as sub-scale scores. Large psychometric studies have confirmed two orthogonal factors (adaptability and cohesion) with strong inter-item correlations, a minimal correlation with social desirability, ability to discriminate "clinic" families with a variety of problems from "community" families, and convergent and discriminant validity. FACES III items are understood by participants as young as 9 years old (Olson, 1993). For the current sample, the Cronbach alpha was 0.82 for parents and 0.87 for youth.

To score the FACES III, we used the Distance from the Center (DFC) method of computing family type (Olson, Portner, & Lavee, 1985). Using national norms and cut points for families with adolescents, we computed the distance between the current point (as opposed to the ideal) for cohesion (nowc 37.1) and the current point (as opposed to the ideal) for adaptability (nowa, 24.3) from the center: $DFC\_F = ((nowc-37.1)^2+(nowa-24.3)^2)$. This value then places the family within the balanced (.01 thru 4.56), mid-range (4.5601, thru 8.79), or extreme (8.7901 thru highest) types.

Intervention

MP was a 12-hour, 6-session communication skills training program with one 2-hour booster session. Youth and parents attended together at sites throughout the community on weeknights or weekends. The manualized program consisted of cognitive, affective, and behavioral strategies to foster understanding and communication. Consistent with the Circumplex Model (Olson, 1993), the strategies were guided by the concepts of flexible family boundaries and emotional closeness. Each session began with the facilitator, youth, and parents doing a relaxation or centering exercise followed by reflecting on the homework assignment and content from previous sessions. For selected content exercises, youth were separated from parents. Role-play, facilitator skill modeling, and videotaped modeling were used extensively to learn and practice communication skill. Table 1, Program Description of Mission Possible: Parents and Kids Who Listen, provides session-by-session content. Attendance at the intervention sessions was not remunerated.

Problem solving skill is a complex skill built upon basic communication skills such as active listening and problem identification that were presented in earlier sessions. Problem solving was introduced in the fifth session and developed further in the sixth session. The six steps to conflict resolution, consistent with Social Problem Solving Theory (D'Zurilla & Nezu, 1999), were followed. In the first step, youth and parents discussed what a problem consisted of and focused their attention on active listening. In the second step, all possible solutions, no matter how outrageous or how many times they had been tried before, were listed. The emphasis was on brainstorming. In the third step, the pros and cons of each suggested solution were debated. In step four, a solution was chosen agreeable to both parties and a timeline for implementation was developed. Rules and consequences for not following the solution were determined and agreed upon. The dyad tried the solution during the following week and then evaluated it in session six.

Intervention implementation—Each intervention session was led by two facilitators who were trained bachelor's prepared nurses, social workers, educational psychologists, or human development specialists. Facilitator training methods were described in depth by Riesch et al. (2013) and Tosi (1989).

A content checklist, completed by the facilitators, was used to assess implementation fidelity. According to an analysis of the checklists by the research program managers, more than 90% of the parent content and 88% of the youth content was consistently covered (Myers Temkin, Riesch, & Kedrowski, 2011).

Comparison condition—The comparison group participated in the same data collection activities as the intervention group but did not meet as a group or receive an intervention.

Data Collection

All data were collected during visits to the family home between 2005 and 2010. After obtaining signed parental permission and youth assent, demographic characteristics and survey data were collected at five in-home interviews over a period of 3 years using a laptop computer for the parent and a hand-held device for the youth (Bobula et al., 2004). If two parents were present, the parents decided who would be the one participating. Individuals received remuneration of $20 for the first three data collection episodes, $30 for the fourth, and $40 for the fifth. If an individual completed all data collection procedures, s/he could receive $130 over the 3-year period. Strategies to promote participant retention included assigning data collectors to a portfolio of families to maintain continuity, obtaining a next of kin to contact in case the research team could not reach the dyad, and quarterly communication with all families in the form of a newsletter that included content neutral to youth parent communication.

The procedure to assess problem solving skill included the dyad selecting a problem to discuss and attempting to solve the problem while being videotaped. An updated version of the Issues Checklist (Prinz, Foster, Kent, & O'Leary, 1979) was used as a basis for the dyad to select a problem to discuss. It included 30 issues likely to lead to disagreements between youth and parents (screen time, chores). Youth and parents completed identical versions

indicating whether or not each topic had been discussed in the past month. A topic was chosen for discussion. The discussion was videotaped.

The data collector instructed the dyad to discuss the topic for 15 minutes. The data collector then set up the video camera, demonstrated the "camera self" to each participant, left the room, signaled when 5 minutes remained, and then debriefed the dyad as necessary upon completion of the task.

The videotapes were sent to the Institute for Social and Behavioral Research at Iowa State University where they were scored using the IFIRS coding system (Melby & Conger, 2001). Trained Family Interaction Analysts rated the interaction applying the IFIRS. Twenty percent of the videotapes were rated a second time for reliability purposes. If there were differences of 2-steps or greater on any scale, the two raters met to resolve differences. This meeting resulted in a "consensus score" that replaced the original score. A total of 599 tasks were coded by a primary rater; 120 of these were coded for reliability (20%). The average overall agreement was 83% (within 1-step on each item), 12% within 2-steps on each item, and 5% within 3-steps on each item (J. Melby, personal communication, December 12, 2010) well within acceptable reliability parameters (Melby & Conger, 2001).

Analysis

Data were assessed for level and type of missingness. Missing data were assessed at the scale level, in which we encountered a low level of missing data ranging from 1.3% to 8.4% on scaled variables. Little's (1988) test for Missing Completely at Random, where the missingness mechanism does not depend on the variable of interest or any other variable, was run on the scaled variables (family type and problem solving ability). Using Little's test, the assumption of Missing Completely at Random was accepted.

Our study aim was to compare the growth or rate of change (linear slope and acceleration or deceleration of slope) in problem solving skill among youth-parent dyads by study group across time, controlling for youth gender and family type. This intention-to-treat analysis employed two latent growth models using Mplus software package for Windows version 6.12 (L. K. Muthen & Muthen, 1998–2010). The first, the Dyadic Conditional Latent Growth Model for the individual scales, modeled the parent and youth as individuals. The second, the Latent Growth Model for dyadic scales, modeled the parent and youth as a dyad (Curran & Hussong, 2013).

Dyads from the intervention group schools potentially attended MP sessions together, therefore, dependency or nesting among the outcomes was assessed using a measure of design effect (Kish, 1965). The design effect is a function of the average number of dyads attending the intervention sessions, the coefficient of variation of nest size, and the intra-class correlation coefficient. Design effects greater than 2 indicate that nesting needs to be considered in the model (B. O. Muthen & Satorra, 1995).

Effect sizes were assessed. Faraone (2008) explained that an effect estimate places an interpretable value on the direction and magnitude of intervention impact. As a standardized, unit-less value, it permits comparison across studies that used different metrics to examine

treatment effects. We estimated a delta effect size for our growth models. We used the Rye et al (2005) equation of $\delta_S = \beta_1/\sigma$ for our linear slopes, and proposed a $\delta_I = \beta_0/\sigma$ for intercepts, and $\delta_Q = \beta_2/\sigma$ for our quadratic components. We interpreted the effects sizes as small (0.2 – 0.4), moderate (0.5 – 0.7), and large (0.8) analogous to Cohen's *d* (Feingold, 2009). Calculation of 95% confidence intervals facilitates comparisons of similar studies (Conn, Chan, & Cooper, 2014).

Results

Sample Description and Baseline Equivalence

The number of dyads who participated in the problem solving task was 154. Some dyads had missing data for various waves because on occasion youth or parents did not have time or wish to participate in the task. In order to build trajectories in the Latent Growth Model, at least two data collection points were necessary. Therefore, 27 dyads (n = 21 intervention and n = 6 comparison) were dropped because they participated in only one data collection wave. A sample of 127 dyads (n = 62 intervention and n = 65 comparison) was included for data analysis, the number of data points each dyad participated in is displayed in Figure 1, CONSORT diagram. There were no statistically significant differences in age, income, education level, partner status, gender, and race between the dropped and retained dyads. Attendance at MP by dyads is reported in the CONSORT diagram.

As displayed in Online Resource 1, Demographic Characteristics of Parents and Youth, a few fathers participated (n = 11), but most parents were mothers who were well-educated, married, with an annual income above $50,000. Youth and parents self-reported their race and ethnicity independent of one another and it matched the population at the recruitment schools. Adults' mean age was 42 (SD = 5.7) and youths' was 10.5 (SD = 0.6) years at intake. All adults were biological parents of the youth and all youth were age appropriate for grade five.

Family type was in the unbalanced range for 43% of the families. Nearly one-third scored in the mid-range, and 18% scored in the balanced range. We combined the mid-range and balanced family types and refer to them as balanced. There is both analytical precedent (Tiesel, Miller, & Olson, 1995) and theoretical support for this practice (Kantor & Lehr, 1975).

There were more balanced family types in the comparison than in the intervention group (p = 0.05). The demographic characteristics of the dyads in the intervention group did not differ significantly from those in the comparison group.

Description of the Problem Solving Scales by Group and Time

In Online Resource 2, Distribution of Problem solving Scales by Group and Wave with Sample Sizes and Means, the mean and standard deviation for each IFIRS scale for youth and parent by study group and across five waves are displayed. A visual depiction of the overall growth trajectories is displayed in Online Resource 3, Overall Growth Trajectories for Individual Problem Solving Scales for Intervention and Comparison Groups, and Online Resource 4, Overall Growth Trajectories for Dyadic Problem Solving Scales for Intervention

and Comparison Groups. Increases in scale raw mean scores typically occurred at Wave 2 in the intervention group, coinciding with the post-intervention assessment.

Examination of Online Resource 2 and Online Resource 3 reveals that youth in the intervention and comparison groups consistently scored at lower levels than parents on the individual problem solving scales at intake and subsequent waves. Youth in the intervention group demonstrated better scores on the individual scales at Waves 2 through 4 for Solution Quantity and Quality but decreased below intake and comparison group levels by Wave 5. There was little difference between the intervention and comparison group scores for youth Negotiate/Compromise. Further, the scores were very low indicating youth in both groups offered little willingness to change, negotiate, or compromise. Parents in the intervention group scored slightly above those in the comparison group scores at all Waves for the individual problem solving scales except at intake for Solution Quantity.

In Online Resource 2 and Online Resource 4, we see that the intervention group began the trial with higher scores and remained so throughout the study for the dyadic problem solving scales. Scores for Agreement on Solution were above 6.0 (at the high end of the possible 1 through 9 score) in contrast to all the other scales where scores tended to hover at the lower or mid-points. Scores dipped over time for Implementation Commitment.

Hypothesis Testing and Magnitude Effects

There were 22 series of MP with an average enrollment of 5 dyads (minimum 3 and maximum 10). There were eight outcome measures, six youth and parent individual problem solving skill scales – Solution Quantity, Solution Quality, and Negotiation Compromise and two dyadic problem solving skill scales – Agreement on Solution and Implementation Commitment. For the eight outcome measures, design effects ranged from 1.07 to 1.48 and intra-class correlation coefficient ranged from 0.04 to 0.27, all below the rule-of-thumb of 2.0. Subsequently we did not model a multilevel latent growth structure (B. O. Muthen & Satorra, 1995).

Individual scales—We analyzed dyadic growth trajectories assessing group effect (intervention, comparison) while adjusting for youth gender (male, female) and family type (balanced, unbalanced) over time for the six individual scales. The Dyadic Conditional Latent Growth Model analysis allowed us to analyze the observed behavior for parent and youth individually, adjusting for the influence of each member of the dyad's behavior on the other. Mean Dyadic Conditional Latent Growth Model for individual scales for youth and parent are shown in Online Resource 5, Dyadic Conditional Latent Growth Model of Individual Problem-Solving Scales. The range of Model fit determinations are displayed as a note to Table 2.

As displayed in Table 2, Models 1, 2, and 3, the Dyadic Conditional Latent Growth Model revealed no statistically significant group effect for Solution Quantity, Quality, or Negotiate/Compromise for youth or adults. The Rye's delta (Rye et al., 2005), however, indicated a large magnitude positive group effect in the linear rate of change for boys on Solution Quantity (0.82) and Solution Quality (0.67). We did not find this effect among parents, or for Negotiate/Compromise.

Dyadic scales—We analyzed growth trajectories assessing group effect (intervention, comparison) while adjusting for youth gender (male, female) and family type (balanced, unbalanced) over time for the two dyadic scales. The Conditional Latent Growth Model analysis allowed us to assess the observed behavior for the dyad. Mean Conditional Latent Growth Model for dyadic scales are depicted in Online Resource 6, Conditional Latent Growth Model of Dyadic Problem-Solving Scales.

As displayed in Table 2, Models 4 and 5, the Conditional Latent Growth Model analysis revealed no statistically significant group effect for Agreement on Solution or Implementation Commitment. There was, however, a large magnitude positive group effect in the linear rate of change for Agreement on Solution (0.85) and Implementation Commitment (0.77).

Covariate analysis for individual scales—We then examined the covariates of youth gender and family type for effects on the individual scales. Online Resources 7a–7e, provide scores for each scale by gender and family type. Boys began the trial with statistically significant lower scores than girls on Solution Quantity and Solution Quality but not Negotiate/Compromise.

Adjusting for youth gender, parents with boys demonstrated a moderate positive magnitude group effect in the linear rate of change for Solution Quantity (0.61) and a large positive group effect for Negotiate/Compromise (1.18). These results are displayed in Table 2, Models 1 and 3.

For family type, parents from the unbalanced family type (Table 2, Model 1) demonstrated a statistically significant difference and large magnitude positive group effect in the linear rate of change for Solution Quantity (1.34). Youth from the unbalanced family type demonstrated a moderate magnitude positive group effect in the linear rate of change for Solution Quality (0.59; Table 2, Model 2). A large magnitude positive group effect in the linear rate of change was found for parents from the unbalanced family type on Negotiate/ Compromise (1.35; Table 2, Model 3).

In other words, parents from the unbalanced family type, in contrast to the balanced family type, had a higher linear rate of change for Solution Quantity and Negotiate/Compromise. Parents of boys, in contrast to parents of girls, demonstrated a similar rate of change. Youth from the unbalanced family type, in contrast to the balanced family type, had a higher linear rate of change only for Solution Quality.

Covariate analysis for dyadic scales—The covariates of youth gender and family type were examined for the dyadic scales. For youth gender, we found a positive moderate group effect in the linear rate of change for Agreement on Solution (0.59; Table 2, Model 4 and 5) among dyads with boys and a large positive group effect in the linear rate of change on Implementation Commitment (−1.38) among dyads with girls (Table 2, Model 4 and 5).

Dyads from the unbalanced family type had a statistically significant difference and a large positive group effect in the linear rate of change on Agreement on Solution (2.30; Table 2,

Models 4 and 5). Dyads from the unbalanced family type had a large positive group effect for linear rate of change on Implementation Commitment (1.66; Table 2, Model 4 and 5).

In other words, dyads with boys had a higher linear rate of change for Agreement on Solution while dyads with girls had a higher linear rate of change for Implementation Commitment. Similarly, dyads from the unbalanced family type had a higher linear rate of change for Agreement on Solution and Implementation Commitment than dyads from the balanced family type.

Discussion

The lack of support for the hypothesis requires us to examine our methods, theories, and the entwined limitations. We anticipated that more predominantly minority-enrollment schools would serve as recruitment sites in Chicago. Despite a history of strong relationships between the research institutions and Chicago high schools, this did not carry through to elementary schools. Several elementary school administrators said they would have participated if their school had been an intervention school. In addition, youth-parent response rates to study invitations from schools in both cities were low implying a potential recruitment bias. As a result, our study sample was predominantly Caucasian, married, well-educated, with middle to upper class incomes.

Problem solving skill, particularly among parents and youth, may constitute what Prentice and Miller (1992) referred to as a "difficult to influence" dependent variable. Twelve hours of communication skill training, with 2 to 4 hours focused upon problem solving ability in the context of 10 to 12 years of a youth-parent relationship may constitute what they refer to as a "minimal manipulation" of the independent variable.

The content on problem solving occurred in the fifth of six sessions; therefore, there was limited time to apply the skills during the intervention period. Important revisions of the content include placing the problem solving skill content earlier in the program. Dyads would have more time to incorporate and practice the skills and obtain guidance from facilitators if there were difficulties with implementation.

The intensity of the problem solving content may need to be enhanced for it to stick. Potential ideas to achieve greater intensity for the problem solving content include the use of games or other technology to promote engagement, use of participant suggested problems instead of the current problem list approach, and setting *a priori* mutual goals among youth and parents for problem solving. In other words, youth and parents could be coached to articulate what outcomes they hope to achieve from the intervention, such as improved listening, more time allocated to problem solving, use of specific terms and words, and the like.

Addressing dose, which would require a larger sample for this paper, may shed more light on the level of intensity needed for optimal outcomes. Roughly 20% of the dyads were absent from the MP session that focused upon the problem solving content (Figure 1, CONSORT Diagram). Additionally, homework completion between sessions may influence results.

Most of the balanced family type dyads were in the comparison group confounding the influence of the group effect on the outcomes. Though randomization was used at the school level, it is possible that youth-parent dyads of the unbalanced family type from the intervention schools were likely to enroll in the study because they sought help for communication or problem solving. Determining the reason dyads joined the trial may provide insight into their goals and motivations.

D'Zurilla et al. (2004) placed the problem solving process into a context of problem orientation (positive or negative) and problem solving style (rational, impulsive, or avoidance). We limited measurement of problem solving skill to the 6-step problem solving process. Measuring the context and style in addition to the process may provide insight into how the dyad perceived problem solving in general and the task before them specifically. Further, youth parent relationships are complex and multifactorial, thus, it is highly likely that not all relevant relationship domains were tapped by the instruments used.

We selected the Latent Growth Model analysis because it is an excellent approach for studies examining complex behavior with limited sample sizes (Hamilton, Gagne, & Hancock, 2003). Based upon power analyses, we recruited a sample of adequate size but as the youth increased in age and sophistication over the study period they found they could refuse participation in study tasks and exercised their right to do so on occasion. In other words, they would complete the surveys but decline to participate in the videotaped task citing they didn't want to or didn't have time. As a result, 27 dyads were lost in the final analysis because they did not have data from two or more waves. A larger sample size would allow analysis of potential factors influencing youth parent problem solving ability such as pubertal development and openness of communication.

To convey a complete meaning of the results and examine the potential for efficacy of MP for problem solving skill, we conducted effect size analyses. Magnitude effects may be useful in the conduct of replication or future meta-analytical studies of problem-solving (Roberts & Henson, 2003). Two important covariates were examined – youth gender and family type.

The youth gender magnitude effect could be attributed to a regression effect among the boys or a ceiling effect among girls. We think that the increase in boys' skill is relevant for three reasons. First, research suggests that boys in general talk less with parents (Leaper et al., 1998). Second, surveys suggest that boys typically report less emotional support than girls (Olsson, Fahlen, & Janson, 2008). Third, boys tend to have fewer prosocial skills or develop them later than girls (Kosterman et al., 2001). Boys' involvement in the intervention and problem solving tasks may have provided opportunities to talk, access emotional support, or develop prosocial skills that in turn contributed to their tendency to increase in skill. Dyads with girls demonstrated large magnitude group effects for Implementation Commitment. Perhaps the relationship orientation of Implementation Commitment favored girls (Fivush et al., 2004).

Turning to the family type findings, the scores for 43% of the families in the current study indicated the unbalanced type. Other investigators, all of whom studied distressed families

with similarly aged children, reported a lower proportion. Olson et al. (1985) reported 36%, McGuigan et al. (2014) reported 20%, and Carvalho, Freitas, Leuschner, and Olson (2014) reported 27% of their sample as the unbalanced family type. Olson and Gorall (2003) indicated that some families function well at the unbalanced range but not over the long term unless they were satisfied. In future studies, two questions should be asked, "Do community dwelling families dealing with the challenges of impending and early adolescence find themselves tested to maintain a balance of adaptability and cohesion as a course of normal development?" and "To what extent are families of the unbalanced type satisfied?" Also with regard to family type and contrary to expectations based on the Circumplex Model (Olson, 1993), parents from the unbalanced family type relative to parents from the balanced family type demonstrated a higher linear rate of change for Solution Quantity and a large magnitude effect for Negotiate/Compromise. The unbalanced family type, according to the Circumplex Model (Olson, 1993), demonstrates more rigidity and disengagement than the balanced family type. As such, parents from the unbalanced family type may perceive they control the problems discussed and exert more control over solutions to problems than parents from the balanced family type (Smetana, 2005).

The use of the Circumplex Model to guide practice and research with community dwelling families is limited. It has been used to underpin counseling and investigating families with problems such as alcoholism and delinquency. Even minimal progress with families understanding and accepting their cohesion, flexibility, and communication are heralded. Perhaps it actually makes some sense that members of a community dwelling unbalanced family type would benefit more from problem solving skill training over the balanced type (McGuigan et al., 2014). Possibly, the balanced family types already utilized problem solving skills similar to those taught while youth and parents of the unbalanced family type found the skills new, worthwhile, and to make a difference for them.

Family researchers and practitioners may utilize our experience conducting this trial as lessons learned. First, our recruitment process included obtaining permission from the schools at the district level, stratifying for race and randomizing individual schools to intervention and comparison conditions, and then approaching the individual schools to serve as recruitment sites. Upon reflection, we recommend talking with school personnel and parent groups from all the individual schools within the districts prior to randomization to ascertain level of interest and willingness to accept random assignment. This approach has been successfully used by Chang and colleagues (2009) to achieve a receptive participant pool, reduce refusal rates, and improve racial and ethnic diversity of the sample. Further, the offer of a wait list control opportunity may improve schools' likelihood of participation.

Second, we conceptualized MP as a universal intervention because increasing conflict among parents and their young adolescents is well documented as a universal phenomenon. Bolstering communication skill, particularly problem solving skill, may reduce the conflict and maintain or even enhance the relationship. However, the study of sub-groups (unbalanced family type, families with boys) may document for whom and under what conditions such an intervention is efficacious (Small & Memmo, 2004).

Third, separate remuneration for study participation should be made for separate tasks. In the current study, remunerating dyads for the problem solving tasks above and beyond the survey tasks may have maintained their participation at each wave over the study period and allowed construction of additional models with important covariates.

Fourth, determine at intake interviews the dyads' motivations for joining a study of communication. Doing so would make it possible for dyads to articulate their goals and provide facilitators opportunities for coaching to achieve the dyads' goals as part of the intervention.

Fifth, based on effect sizes, we maintain that MP has promise as a dyadic intervention. The decreasing comparison group raw mean scores over this trial portends that problem solving increases in difficulty during the developmental period.

Sixth, important additions for theory and measurement include addressing the context of the problem. Inclusion of an additional theory that examines and measures who controls young adolescent behavior with regard to the problem under discussion (parent or youth) and how (authoritative or authoritarian) may provide added explanation for problem solving processes (Smetana, 2005). Expanding measurement to include additional aspects of the Social Problem Solving Theory, whether the approach and styles of working on it are positive or negative, rationale, impulsive, or avoidant would provide context for the problem solving context (D'Zurilla & Nezu, 1999).

In summary, the Conditional Latent Growth Modeling analysis revealed no statistically significant differences in problem solving skill among the youth-parent dyads over time between groups. Analyses of effect sizes indicated large magnitude group effects for selected scales for youth and dyads portraying a potential for efficacy and for whom if study limitations and lessons learned were addressed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Enrollment and
Randomization

From a list of all elementary schools in each city, 28 public elementary schools in Madison WI and 17 in Chicago IL were stratified for predominantly African American enrollment (> 60%), randomly selected, randomly assigned to intervention and comparison conditions, and invited to serve as recruitment sites

Schools in Madison, WI
- 14 (2 with >60% African American enrollment) Randomized to Comparison Group
- 14 (1 with >60% African American enrollment) Randomized to Intervention Group
- 2 Declined to Participate (1 in each condition)

Schools in Chicago, IL
- 9 (6 with >60% African American Enrollment) Randomized to Comparison Group
- 8 (1 with >60% African American Enrollment) Randomized to Intervention Group
- 12 Declined to Participate (All (9) comparison, 3 intervention)

Dyads Invited = 4711
Responded to Invitation = 485
Assessed for Eligibility = 406
Eligible = 361
Consented = 302

Allocation

Allocated to intervention group (n= 189)
Enrolled (n = 189)
Received allocated intervention (n=138)
Did not receive intervention (n= 51)
    Reasons: Did not show (n =44)
              Changed mind (n = 7)
Allocated to Problem Solving Task (n = 83)

Allocated to comparison group (n=172)
Enrolled (n = 164)
Did not enroll (n = 8)
       Reason: Changed mind (n= 8)

Allocated to Problem Solving Task (n=71)

Follow-Up

Lost to follow-up in full study (n= 10)
    Reason: Unable to locate
Discontinued intervention (n=1)
    Reason: Not worth his time

Lost to follow-up in full study (n=32)
    Reason: Unable to locate
Discontinued participation (n = 0)

Analysis

Total Analyzed (Full study):
*W 1 =149, W 2 = 118, W 3 =115, W 4 = 128, W 5 = 128
Analyzed for problem solving skill (n= 62)
Excluded from analysis (n= 21)
  Reason: Less than 2 data collection points
Participation in Problem Solving Task: *W 1 = 56, W 2 = 52, W 3 = 42, W 4 = 42, W 5 = 44
Participation in MP: *S 1 = 50, S 2 = 51, S 3 = 49, S 4 = 48, S 5 = 47, S 6 = 54, Booster = 47

Total Analyzed (Full study):
*W 1 = 149, W 2 = 146, W 3 = 141, W 4 = 141, W 5 = 140
Analyzed for problem solving skill (n=65)
Excluded from analysis (n= 6)
    Reason: Less than 2 data collection points
Participation in Problem Solving Task: W 1 = 58, W 2 = 61, W 3 = 60, W 4 = 57, W 5 = 54

Figure 1. Consort Diagram
*W is Wave, S is Session

Table 1

Program Description of Mission Possible: Parents and Kids Who Listen

Session	Name	Goals	Concepts Taught in Training Sessions	Circumplex Model of Family Systems/Social Problem Solving Theory
1	Developmental Changes	Enhance parents' and youths' understanding of growth/development between themselves and others	• Using role play, physical, cognitive, and psychosocial changes are addressed, as is how these changes affect communication.	Adaptability and Cohesion
2	Effects of Self-Esteem	Familiarize parents and youth with the theory and concepts of self-esteem.	• Parenting styles are introduced. • Fundamental issues of open communication are introduced, including the transmission and reception of meaning, communication as behavior, and the relationship between behaviors of interacting individuals. • Through vignettes, parent and youth learn how communication approaches and parenting styles can result in feelings about one's self.	Communication
3	Getting What You Want	Address concept of emotional inheritance and learn the skill of clear and assertive expressions of expectations, values, feelings, caring, and needs.	• Problem ownership is demonstrated. • The sensing-thinking-feeling-wanting-doing paradigm for becoming aware of one's part in a relationship is taught and return demonstrated. • Methods for re-channeling feelings are explored. Communicating needs and wants is viewed as a life skill transferable to many situations. • "I-messages" as a confrontation skill are introduced. • Using parents' and youths' examples, problem identification and ownership is discussed.	Communication
4	Listening to What the Other Wants	Enhance parents' and youths' awareness of open and closed communication and facilitate identification and feeling of blocked communication.	• 5 basic listening skills are introduced: nurturing, supporting, comforting, guiding, and enabling. Communication theory is taught (codes, feedback, affirmation and denial). • Further exercises in confrontation, listening, and in approaching difficult topics are demonstrated.	Communication
5	Solving Conflicts So Everyone Wins	Facilitate parents' and youths' awareness of their patterns of communicating during conflicts and enhance parents and youths abilities to resolve conflicts.	• 6 Steps to conflict resolution: defining a problem, identifying possible solutions, evaluating the possible solutions, choosing a solution, implementing the solution, and evaluating the implemented solution. • Situations of conflict illustrating differences between parent's	Communication Problem solving

Session	Name	Goals	Concepts Taught in Training Sessions	Circumplex Model of Family Systems/Social Problem Solving Theory
			values and expectations and youth behavior and autonomy are coached and modeled.	
			• Negotiation, autonomy, and connection are stressed.	
6	Celebrating and Letting Go	Enhance parents' and youths' abilities to be successful in their relationships, increase their awareness of mutual psychosocial needs, and facilitate parents' ability to allow the youth to connect and separate.	• Needs for achievement, satisfaction, and opportunities to follow and lead are addressed. • Responsibility, relationships, discipline, and appreciation are emphasized within a paradigm of allowing expression and experimentation with a number of roles and behaviors.	Adaptability and Cohesion
7	Booster Session	Illustrate how communication supports the development of self-esteem	• Review the concepts of self-esteem, active listening, and the awareness wheel.	Communication

Table 2

Unstandardized Estimates for Three Models of Dyadic Conditional Latent Growth Model for Individual Scales and Two Models of Conditional Latent Growth Model for Dyadic Scales Adjusting for Group (intervention, comparison), Youth Gender (male, female), and Family Type (balanced, unbalanced)

Model 1: Dyadic Conditional Latent Growth Model for Solution Quantity

		Youth Individual Solution Quantity			Parent Individual Solution Quantity		
Variable	Parameter	Intercept (I)	Linear Slope (S)	Quadratic (Q)	Intercept (I')	Linear Slope (S')	Quadratic (Q')
Group	β	-0.53	1.00	-0.24	-0.27	0.48	-0.08
	SE	(0.46)	(0.54)	(0.13)	(0.49)	(0.52)	(0.13)
	95% CI	[-1.43;0.37]	[-0.05;2.06]	[-0.50;0.03]	[-1.23;0.70]	[-0.55;1.51]	[-0.33;0.17]
		-0.32	*0.82*	*-0.76*	*-0.12*	*0.33*	*-0.24*
Youth Gender	β	-1.42*	0.44	-0.07	-0.65	0.91	-0.27*
	SE	(0.46)	(0.50)	(0.12)	(0.49)	(0.53)	(0.13)
	95%CI	[-2.33; -0.51]	[-0.53;1.42]	[-0.31;0.17]	[-1.62;0.32]	[-0.14;1.95]	[-0.52;0.02]
		-0.86	*0.36*	*-0.21*	*-0.34*	*0.61*	*-0.84*
Family Type	β	0.10	0.08	-0.03	-1.01	1.98*	-0.48*
	SE	(0.62)	(0.68)	(0.15)	(0.56)	(0.65)	(0.15)
	95% CI	[-1.11;1.13]	[-1.25;1.41]	[-0.33;0.27]	[-2.11;0.08]	[0.70;3.27]	[-0.79; -0.17]
		0.06	*0.06*	*-0.10*	*-0.52*	*1.34*	*-1.49*

Model 2: Dyadic Conditional Latent Growth Model for Solution Quality

		Youth Individual Solution Quality			Parent Individual Solution Quality		
Variable	Parameter	Intercept (I)	Linear Slope (S)	Quadratic (Q)	Intercept (I')	Linear Slope (S')	Quadratic (Q')
Group	β	-0.17	0.84	-0.22	0.22	0.01	0.02
	SE	(0.37)	(0.50)	(0.12)	(0.32)	(0.38)	(0.09)
	95% CI	[-0.89;0.56]	[-0.13;1.80]	[-0.45;0.01]	[-0.43;0.83]	[-0.74;0.76]	[-0.16;0.19]
		-0.16	*0.67*	*-0.85*	*0.17*	*0.01*	*0.08*
Youth Gender	β	-0.80*	0.47	-0.11	0.11	0.05	-0.04
	SE	(0.37)	(0.47)	(0.11)	(0.31)	(0.37)	(0.09)
	95%CI	[-1.53; -0.07]	[-0.45;1.39]	[-0.33;0.11]	[-0.49;0.72]	[-0.68;0.78]	[-0.21; 0.14]
		-0.78	*0.37*	*-0.41*	*-0.09*	*0.04*	*-0.16*
Family Type	β	-0.61	0.74	-0.16	-0.39	0.48	-0.04
	SE	(0.50)	(0.62)	(0.14)	(0.37)	(0.52)	(0.09)

(continued from previous page)

Parameter						
95% CI	[-1.59;0.37]	[-0.48;1.95]	[-0.44;0.11]	[-1.12;0.33]	[-0.53;1.50]	[-0.34;-0.14]
	-0.60	*0.59*	*-0.62*	*-0.32*	*0.44*	*-0.45*

Model 3: Dyadic Conditional Latent Growth Model for Negotiate Compromise

Variable	Parameter	Youth Individual Solution Quality			Youth Individual Solution Quality		
		Intercept (I)	Linear Slope (S)	Quadratic (Q)	Intercept (I')	Linear Slope (S')	Quadratic (Q')
Group	β	0.02	0.03	-0.02	0.24	-0.14	0.03
	SE	(0.09)	(0.11)	(0.03)	(0.24)	(0.25)	(0.06)
	95% CI	[-0.17;0.20]	[-0.19;0.25]	[-0.07;0.04]	[-0.22;0.70]	[-0.64;0.36]	[-0.09; 0.16]
		0.32	*0.11*	*-0.22*	*0.34*	*-0.49*	*0.49*
Youth Gender	B	-0.06	0.06	-0.02	-0.14	0.34	-0.10
	SE	(0.09)	(0.12)	(0.03)	(0.23)	(0.24)	(0.06)
	95% CI	[-0.23;-0.12]	[-0.17;0.29]	[-0.07;0.04]	[-0.59;0.32]	[-0.14;0.82]	[-0.22; 0.01]
		-1.16	*0.23*	*-0.26*	*-0.20*	*1.18*	*-1.49*
Family Type	β	0.10	-0.09	0.02	0.01	0.39	-0.10
	SE	(0.14)	(0.17)	(0.04)	(0.28)	(0.29)	(0.06)
	95% CI	[-0.18;0.38]	[-0.43;0.25]	[-0.06;0.10]	[-0.54;0.56]	[-0.18;0.95]	[-0.23;0.03]
		2.03	*-0.35*	*0.30*	*0.02*	*1.35*	*-1.48*

Model 4 and Model 5: Conditional Latent Growth Model for Dyadic Scales

Variable	Parameter	Agreement on Solution			Implementation Commitment		
		Intercept (I)	Linear Slope (S)	Quadratic (Q)	Intercept (I')	Linear Slope (S')	Quadratic (Q')
Group	β	0.10	0.56	-0.10	0.42	0.32	-0.08
	SE	(0.45)	(0.52)	(0.13)	(0.48)	(0.54)	(0.13)
	95% CI	[-0.78;0.97]	[-0.49;1.61]	[-0.35;0.15]	[-0.51;1.35]	[-0.74;1.39]	[-0.34;0.17]
		0.07	*0.85*	*-0.79*	*1.95*	*0.77*	*-0.48*
Youth Gender	β	-0.19	0.39	-0.10	0.06	-0.58	0.11
	SE	(0.43)	(0.52)	(0.13)	(0.48)	(0.50)	(0.11)
	95% CI	[-1.04;0.67]	[-0.63;1.40]	[-0.35;0.14]	[-0.91;1.02]	[-1.55;0.40]	[-0.11;0.33]
		-0.14	*0.59*	*-0.79*	*0.26*	*-1.38*	*0.64*
Family Type	β	-0.75	1.52*	-0.29	-0.04	0.67	-0.15
	SE	(0.58)	(0.68)	(0.15)	(0.57)	(0.64)	(0.15)
	95% CI	[-1.89;0.39]	[0.19;2.85]	[-0.59;0.01]	[-1.15;1.07]	[-0.56;1.98]	[-0.46;0.15]
		-0.54	*2.30*	*-2.23*	*-0.20*	*1.66*	*-0.89*

Note:

*
p<0.05.

Model Fit Ranges: N=114; X^2=(13.79–66.10); df=(17–46); X^2/df=(0.81–1.62); p=(0.01–0.68); Comparative Fit Index=(0.90–1.00); Tucker Lewis Index=(0.75–1.11); Standardized Root Mean Square Residual=(0.00–0.07); Root Mean Square Error of Approximation=(0.06–0.08).

Note: Referents were comparison group, female gender, and balanced family type.