

Parent views of involvement in their child's education: A Rasch model analysis

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Abstract

The theoretical basis for the study was the assumption that parental involvement in a child's education is an important aspect of school culture and that school renewal efforts intended to change the prevailing culture need to take into account the role of parents.

Data (N=1,672) from administration of a 40-item rating scale instrument designed to elicit parent views of their involvement in their child's education were analysed using the Rasch model. The analyses were used to test the construct validity of an hypothesised model of parental involvement and the capacity of the instrument to measure the hypothesised components. The components were: Child's view of the importance of schooling, desire to learn, and achievement and engagement; the school's focus on children, learning and on education generally; and provision of information from teachers, teachers' commitment to working with parents, and parent confidence in communicating with the teacher.

The instrument was shown to be eliciting data that did not fit the original theoretical model and in cognisance of the need for content validity and accurate measurement, the instrument was refined.

Data from the refined instrument were then analysed to produce measures of different aspects of parental involvement as perceived by the parent respondents.

PARENT VIEWS OF INVOLVEMENT IN THEIR CHILD'S EDUCATION: A RASCH MODEL ANALYSIS

Background

Since the early 1990's there has been increased criticism of school improvement initiatives based upon organisational restructuring and top-down change processes that fail to recognise the "depth, range and complexity of what teachers do" (Bascia & Hargreaves, 2000 p. 4). In response to this criticism, the notion of school improvement has been reconceptualised with an increased emphasis on the necessity for a re-culturing process to occur within school communities that changes belief and value systems throughout the school (Dalin, Rolff & Kleekamp, 1993; Fullan, 1993; Glickman, 1992; Harris, 2001; Sergiovanni, 1992 & 2000). This move is consistent with the assertions of proponents of school renewal (see Glickman, 1992; Goodlad, 1999 & Sirotnik, 1999) - "school renewal is a model of transformative change that brings about multi-levelled structural, social, pedagogic and educational changes through human agency" (Silcox, Cavanagh & MacNeill, 2003, p.2). Cavanagh and Dellar (2002, p. 217) emphasised the need for these changes to have a pedagogic as well as re-culturing focus - "... [this] requires re-culturing the individual classroom by the development of alternative beliefs and attitudes towards classroom instruction and learning". From this perspective, the focus of the change press should be on the classroom and on the factors that improve students' learning. While the students, the teacher, the instructional program and the learning activities are obvious influences on the classroom culture, this culture is also influenced by the family and home background of the individual student (Cavanagh & Dellar, 2001). That is, the dispositions and behaviours of students within the classroom are also influenced by home and family. In particular, the effect of family and home on student achievement is well established (Coleman, 1998; Lingard, 2001; McCall, Smith, Stoll, Thomas, Sammons, Smees, MacBeath, Boyd & MacGilchrist, 2001; Waugh & Cavanagh, 2002). Consequently, the rationale for the study reported in this report is that research into school renewal should take into account the effect of parental involvement in the child's education.

The seminal research into parental involvement was Coleman's (1998) large scale study of parental involvement in Canadian schools. The major finding was that the active participation of parents in classroom and school instructional programs had a positive effect on student learning. Further, that the commitment and responsibility for the child's learning should be shared between parents, teachers and the child. Coleman (1998) considered that when this partnership was fully functional, it would be evidenced by a level of trust, respect, and agreement with teachers, parents and students working together as members of an educational community (Coleman, 1998).

In Western Australia, Cavanagh and Dellar (2001) investigated the views of 526 parents of secondary school student about their involvement in their child's education. A rating scale survey was administered to collect data from parents on student perceptions of the outcome of their child's schooling and learning and also of parent, school and teacher variables. The outcome variables were: Student educational values; Student learning outcomes; Student learning preferences. The parent, school and teacher variables were: Parent to student expectations; Parental confidence to assist student; Parental confidence in communication with teachers; School culture; Student to parent assistance requests; Student to parent information; and Teacher to parent communication. When correlational analyses of the data were conducted, the study concluded that, with the exception of Teacher to parent communication, the outcome variables were associated with the parent, school and other teacher variables. In a subsequent investigation, Waugh and Cavanagh (2002) applied an alternative method of data analysis using the Rasch model (Rasch, 1960/1980) to ensure the data complied with stringent measurement criteria.

The second investigation measured parent perceptions of 15 aspects of parental involvement. These were: Importance of schooling; Goal orientation; Desire to learn; Formal achievement; Engaging in school work; Information from child about school work; Information from child about school activities; Information from child about school problems; Parental views of the school ;

School focus on children and learning; School focus on education generally; Provision of information from teachers ; Teachers’ commitment to working with parents; Parent-reported confidence in communicating with teachers; and Parent-reported confidence to support child’s learning. The results showed that the parents had affirmative views of 14 constructs showing they were positively involved in many aspects of their child’s schooling. The exception was a negative perception of teacher commitment to working with parents. Therefore, it was concluded that the weakest link in the three-way partnership between parents, the child and the teachers was the teachers and their reluctance to proactively relate to parents. This finding was similar to that from the previous study.

In 2004, the instrument developed by Waugh and Cavanagh (2002) was used to collect data from a sample of parents in 26 Western Australian primary and secondary schools. The following is a report of the 2004 study.

Research objectives

The investigation sought to achieve the following objectives.

1. To refine and validate a scale to measure parent views of their involvement in their child’s education;
2. To measure the strength of parent views about different aspects of their involvement in their child’s education; and

Research method

The questionnaire *Parent Attitudes towards Classroom Environment and Educational Outcomes* (Waugh & Cavanagh, 2002) was completed by 1672 parents and returned to the school in a sealed envelope. Parents responded to 40 items on a four point Likert scale ranging from 4 (*strongly agree*) to (*strongly disagree*). The number of questionnaires that were returned and processed is presented in Table 1. The sample was predominantly Years Five to Seven primary school parents with the inclusion of approximately 20% lower secondary parents. It should be noted that the *Parent Attitudes towards Classroom Environment and Educational Outcomes* was developed from a study using data from a sample of lower secondary school parents and had not been validated for primary school parents.

Table 1
Sample characteristics (N=26 schools)

Child’s year of schooling	Sub-sample
Five	494
Six	435
Seven	409
Eight	119
Nine	157
Ten	58
Total	1672

Data from the surveys was entered into the Rasch model computer program Rasch Unidimensional Measurement Model (RUMM) (Andrich, Sheridan, Lyne & Luo, 2000). RUMM calibrates the score of a respondent against the difficulty respondents demonstrated in affirming particular items by application of the Rasch rating scale model. The model applies a logistic equation in which the probability of choosing a particular category in the scale is an exponential function of the difference between the parents’ ability to agree (agreeableness’) and the item’s difficulty in permitting agreeable responses (‘disagreeableness’).

RUMM summary test-of-fit statistics were estimated to test the global fit of data from the 40 items to the Rasch measurement model. The psychometric properties of data from each of the 40 items were also examined by calculating individual item fit statistics. This included estimating the residual (difference between the actual score and that predicted by the Rasch model) and testing the fit of item data to the model by calculating Chi-square statistics (Chi-square and the probability level). Concurrently, the capacity of the items to elicit logical and consistent responses to the four response categories was examined by calculating the thresholds between the four response categories for each item. A threshold is the minimum level of ‘agreeableness’ which a parent must have in order to go from one Likert scale response category to the next. When respondents are logical in their choice of response categories, the thresholds should ideally follow in a sequence from lowest to highest, in keeping with the order of the response categories from *strongly disagree* to *strongly agree*.

Next, the results of the RUMM analysis were scrutinised to see if the measurement capacity of the instrument could be improved by deleting certain items. Consequently, items eliciting data with poor fit to the model were deleted from a subsequent RUMM analysis of data from a modified instrument on the assumption that this version of the instrument would be a more accurate measure. That is, to achieve the second research objective by conducting a second analysis to validate what was assumed to be an improved measure.

Ascertaining the strength of parent views, the second research objective, was achieved by estimating the relative difficulty respondents encountered when asked to affirm the respective items. The ‘difficulty’ of items (‘disagreeableness’), as estimated in a RUMM analysis is expressed in logits (logarithmic units), as is the ability of parents (‘agreeableness’).

Results

First, RUMM summary test-of-fit statistics were estimated for the 40-item data (see Table 2 below).

Table 2
Summary of test-of-fit statistics

Item-person interaction				
	Items		Persons	
	Location	Fit Residual	Location	Fit Residual
Mean	0.00	-0.85	-1.83	-0.62
SD	0.54	3.29	1.47	2.12
Item-trait interaction			Reliability indices	
Total Item Chi Squ	1154.7		Separation Index	0.96
Total Deg of Freedom	360.0		Cronbach Alpha	0.95
Total Chi Squ Prob	0.000			
Power of test-of-fit				
Power is excellent [Based on SepIndex of 0.96]				

When the data fit the model well, the means of the item and person locations (logits) should ideally be zero and standard deviations of the item and person locations (logits) should ideally be 1.0. The locations of parent “agreeableness” in comparison to the locations of item difficulty are less than ideal and lower due to parents having difficulty agreeing with many of the items. Also, the standard deviation of the item locations is low in comparison to the standard deviation of the person locations suggesting the range of item difficulties is less than the range of parent “agreeableness”.

Ideally, the fit residuals which show how well the actual scores correspond to the scores predicted by the model should have means of zero and standard deviations of 1.0. The standard deviation of

3.29 for the item fit residuals is very high and the range and distribution of the differences between the actual and predicted scores are not ideal. That is, many of the items have elicited data that do not conform to the requirements of the Rasch model and this is likely due to the items asking about markedly different aspects of parental involvement leading to very different responses to the 40 items. This finding suggests that the original conceptualisation of parental involvement was likely more complex than expected and thus the 40-item instrument and the data violate the uni-dimensionality requirement for measurement for this sample (see Wright and Masters, 1982).

RUMM individual item fit statistics were estimated to identify the particular items that were contributing to the large range of item residuals shown in Table 1. The results of this analysis are presented in Table 3 below.

Table 3
Individual item fit statistics

Item	Residual	DegFree	DatPts	Chi Sq	Prob	Items cont'd	Residual	DegFree	DatPts	Chi Sq	Prob
1	1.51	1601.9	1646	21.05	0.01	21	2.43	1601.9	1646	25.47	0.00
2	1.55	1601.9	1646	8.76	0.46	22	-2.04	1601.9	1646	9.07	0.43
3	0.42	1601.9	1646	8.64	0.47	23	-1.96	1601.9	1646	17.00	0.05
4	0.38	1601.9	1646	34.63	0.00	24	1.07	1601.9	1646	35.55	0.00
5	1.50	1601.9	1646	17.85	0.04	25	-2.22	1601.9	1646	15.40	0.08
6	2.49	1601.9	1646	45.77	0.00	26	-1.40	1601.9	1646	9.09	0.43
7	-2.18	1601.9	1646	21.71	0.01	27	-3.70	1601.9	1646	18.09	0.03
8	1.24	1601.9	1646	39.71	0.00	28	-4.47	1601.9	1646	37.54	0.00
9	2.18	1601.9	1646	27.70	0.00	29	-4.79	1601.9	1646	34.37	0.00
10	-0.69	1601.9	1646	9.10	0.43	30	-3.71	1601.9	1646	24.21	0.00
11	0.00	1601.9	1646	28.99	0.00	31	-1.60	1601.9	1646	17.52	0.04
12	2.41	1601.9	1646	15.41	0.08	32	-4.20	1601.9	1646	28.08	0.00
13	5.60	1601.9	1646	79.27	0.00	33	-4.43	1601.9	1646	20.99	0.01
14	-0.08	1601.9	1646	4.65	0.86	34	-5.08	1601.9	1646	41.70	0.00
15	6.66	1601.9	1646	74.07	0.00	35	-4.28	1601.9	1646	29.80	0.00
16	0.49	1601.9	1646	12.95	0.17	36	-5.64	1601.9	1646	68.29	0.00
17	-1.46	1601.9	1646	10.49	0.31	37	-6.07	1601.9	1646	65.45	0.00
18	-0.45	1601.9	1646	11.21	0.26	38	-6.13	1601.9	1646	66.46	0.00
19	4.93	1601.9	1646	42.73	0.00	39	-5.42	1601.9	1646	51.78	0.00
20	1.79	1601.9	1646	19.14	0.02	40	1.33	1601.9	1646	5.04	0.83

In regard to the issue of uni-dimensionality, Smith (1996) suggested that items that produce standardised scores that differ by more than ± 2.0 from the actual score are items that are only weakly related to the rest of the items comprising the scale. The residuals for many of the items lie outside this range indicating the 40-item scale was not an accurate measure. Consequently, a stepwise refinement process was undertaken to remove items from the scale that were contributing to large errors of measurement to produce a refined scale that was a more accurate measure. The content validity of the refined scale was particularly important, so in the refinement process, items were retained for each of the constructs considered integral for explaining how the parents were involved in their child's education. At the conclusion of this process, 23 items were retained and these elicited parent views of: their child's learning attitudes, behaviours and desire to learn; communication from the child to the parent about school and schoolwork; the school's focus on learning; and communication from the teacher to the parent. These six constructs were consistent with the assumption of effective parental involvement involving a partnership between the child, the parent and the teacher (see Cavanagh & Dellar, 2001; Coleman, 1998; Waugh & Cavanagh, 2002), and for research to seek information on the roles of all three partners.

A second Rasch analysis was conducted of data from the refined scale. This summary test-of-fit statistics are presented in Table 4 below.

Table 4
 Summary of test-of-fit statistics

Item-person interaction					
	Items			Persons	
	Location	Fit	Residual	Location	Fit Residual
Mean	0.00	-0.55		-1.75	-0.45
SD	0.55	1.33		1.44	1.63
Item-trait interaction			Reliability indices		
Total Item Chi Squ	327.9			Separation Index	0.93
Total Deg of Freedom	360.0			Cronbach Alpha	0.92
Total Chi Squ Prob	0.000				
Power of test-of-fit					
Power is excellent [Based on SepIndex of 0.93]					

Overall, the data complies quite well with the requirements of the Rasch measurement model and many of the problems with the original scale identified previously were not present in these data.

A series of tests were conducted using RUMM. First, the ordering of the thresholds between adjacent response categories was tested. A threshold is the parent ability location level (logit) at which the probabilities of parents choosing two adjacent response categories (e.g. *agree* and *disagree*) are equal. When parents were logical or consistent in their choice of response categories across all the items, the thresholds should be ordered from negative (low) logits to positive (high) logits - 'ordered' thresholds. Alternatively, disordered thresholds are a consequence of the parents being illogical or inconsistent in their choice of response scale categories across the items. The thresholds for all 23 items were ordered (see *Appendix 1: Uncentralised thresholds*). Second, the fit of data from individual items to the model was tested by estimating individual item fit statistics (see *Appendix 2: Individual item fit statistics for the 23 item data*). The residuals for the majority of the items were less than ± 2.0 and the Chi-square probabilities were typically >0.05 . These statistics confirm the good fit of these data to the measurement model. *Appendix 2* also presents item locations. The difficulty parents displayed in affirming the items within the instrument was gauged by calculating the individual item's logit location. A 'logit' is a logarithmic unit, defined as the log odds that the item will present difficulty to the parents in their attempts to affirm the item.

The items were organised within the previously identified six-construct conceptualisation and the respective item locations from *Appendix 2* were included alongside each item (see *Table 5* below). A positive logit shows the item was comparatively difficult for the parents to affirm whereas a negative logit shows the item was comparatively easy for the parents to affirm. For example, the four items eliciting data on the construct of *parent views of the child's learning attitudes* had a range of logits from -0.32 to +1.10. Within these ten items, the most difficult item for the parents to affirm was *school is important for my child* (logit 1.10) and the most easy item was *my child looks forward to going to class* (logit -0.32).

However caution must be exercised in interpreting the meaning of the item location logits. This is because the item location logits have been standardised around a mean value of 0.00 and hence the value of a logit is relative to the range and distribution of all the item location logits. One way to more fully understand the difficulty of the items is to plot the item difficulty on the same scale as the parent ability to affirm the items - see *Appendix 3*. This shows that the items were difficult for the majority of the parents to affirm. While this might suggest that the scale contains many items that were too difficult for the parents, the *Appendix 3* plot does not take into account the range of response categories available to the parents for each item. *Appendix 4* plots the item thresholds against the parent ability measures. The range and distribution of the threshold locations matches the range and distribution of the parent locations reasonably well showing that from a measurement perspective, the items and response categories provided the majority of the parents with viable choices in responding to the scale's items.

Table 5
Constructs, item wording, and item difficulty

<i>Construct/items</i>	Logit
<i>Parent views of child's learning attitudes</i>	
14 My child looks forward to going to class	-0.32
4 My child has a clear view of what he/she needs to learn	-0.21
3 My child believes that his/her future will be improved by what is learnt at school	0.78
1 School is important for my child	1.10
<i>Parent views of child's learning behaviours</i>	
6 My child is in control of his/her own learning	-0.62
11 My child understands the work well	-0.31
10 My child asks for help from his/her teachers when required	-0.23
5 My child likes to do his/her work thoroughly	-0.16
12 My child performs to the best of his/her ability	-0.09
2 My child is comfortable being in classes	0.53
<i>Parent views of the child's desire to learn</i>	
9 Finding new ways to do things is important for my child	0.63
8 My child enjoys finding out how things work	0.83
<i>Parent views of communication from the child about school and schoolwork</i>	
18 My child keeps me informed about classroom activities	-0.26
16 My child usually shows me the work that he/she has done at school	-0.19
20 My child lets me know when he/she needs help with a homework assignment	0.13
<i>Parent views of the school's focus on learning</i>	
24 Individual differences between students are catered for	-1.05
23 The creative potential of students is realized	-0.36
26 There appears to be a vision for the future of the school	-0.31
22 Improvements in student learning are rewarded	0.26
21 There is a belief that every child can learn	0.58
<i>Parent views of communication from the teacher</i>	
31 Teachers keep me informed about classroom activities	-0.82
30 Teachers provide information about the instructional program	-0.35
32 Parents find the teachers at this school approachable	0.43

Note: Item labels are from the original 40-item instrument.

Discussion

Methodological considerations

Implicit in the use of RUMM and testing data fit to Rasch Rating Scale Model was the need for the data to be a measure of the parent trait under investigation for the sample of parents investigated. If the data did not conform to the requirements of measurement, the results of subsequent analyses would be lacking validity and it would be illogical to proceed with these analyses. For this reason, when the data from the 40-items did not conform to the Rasch model, data from the non-conforming items were deleted. It should be noted that this process was contingent on retaining data that fitted the theoretical model underpinning the empirical investigation rather than modifying the theoretical model to fit the data.

The use of the Rasch measurement model enabled calibration of both person ability measures and item difficulty measures as both were transformed into logits. The logits are units on an interval-level scale and because this scale is linear, comparisons of the scores of the parents can be made

accurately. Similarly, the level of difficulty of items can be accurately compared. If raw scores for items or parents were compared, such comparisons would have been unfounded as no unit of comparison exists.

The strength of parent views

The difficulty of the items on *parent views of child's learning attitudes* ranged from 0.32 logits to 1.10 logits. It was easier for parents to affirm that their child looked forward to going to class and had a clear view of what he/she needed to learn than affirming the importance of schooling for the child. This difference might be due to the easier items concerning attitudes to classroom learning within the context of the current classroom while the more difficult items concerned valuing of schooling in general.

The majority of the item difficulty logits for *parent views of child's learning behaviours* were negative because the parents found the items comparatively easy to affirm. However, the parents were less affirmative about their children performing to the best of their ability and being comfortable in class (logits -0.09 and 0.53). The higher difficulty of affirming Item 2 (*my child is comfortable being in classes*) might be a consequence of views of the classroom climate whereas the easier items elicited views of the child's engagement in classroom learning.

In contrast, the two items comprising *Parent views of the child's desire to learn* were more difficult to affirm (logits 0.63 and 0.83). These items focussed on a disposition towards a particular aspect of learning - a disposition towards understanding and gaining new understandings. While this attitude towards learning might be considered an important aspect of motivation to learn, it was less frequently observed by parents than the children demonstrating appropriate behaviours in their learning.

The parents affirmed that their child provided them with information on classroom activities and showed them examples of work completed at school (logits -0.26 and -0.19). However, the parents were less affirmative about the third item concerning communication from the child – asking for help with homework assignments. In general, since communication between the child and parent about the child's learning has been linked to attainment of educational outcomes (see Coleman, 1998), this finding presents a relatively positive view of this aspect of parental involvement for the schools and parents investigated.

The fifth set of items elicited *parent views of the school's focus on learning*. The parents saw the schools catering for individual differences and realising the creative potential of students, also they were aware of the future of the school being informed by a vision (logits -1.05 to -0.31). In contrast, they expressed less confidence that improvements in student learning were rewarded and of the presence of a belief in the need for every child to learn (logits 0.26 and 0.58). The five items asked parents about the school's culture, in particular a culture that was informed by a vision and in which the learning of all children is assigned high importance. Cavanagh and Dellar (2003) drew attention to the importance of school culture being oriented towards improving student learning and to school effectiveness research showing that schools with this type of culture are educationally more effective. Also, an emphasis on pedagogy within the school culture has been proposed as a core construct in re-culturing schools through the school renewal process (Silcox, Cavanagh & MacNeill, 2003). In terms of this study, the parents were somewhat equivocal about the prevalence of a learning-oriented culture in their child's school.

The last set of items centred on *parent views of communication from the teacher*. The parents affirmed that teachers kept them informed about classroom activities and the instructional program (logits -0.82 and -0.35). However, the parents were less sure about the teachers at the school being approachable (logit 0.43). While an equitable partnership between teachers and parents has been associated with improved student learning (Cavarretta, 1998; Kellaghan, Sloane, Alvarez & Bloom, 1993), the difficulty experienced by the parents in affirming the approachability of teachers

suggests this aspect of the teacher-parent relationship might be detracting from overall parental involvement.

Finally, the previous discussion of the difficulty the parents had in affirming the items utilised calibrated scores that were statistically distributed around a mean value of 0.00 logits. As was previously noted in the *Results* section of this report, the calibration process also took into account the parameter of parent ability to affirm all the items and a calibrated score for each parent was also estimated. The interaction between parent ability and item difficulty was presented in *Appendix 3* and *Appendix 4*. These two item maps show that overall, the parents found many of the items difficult to affirm. So while there are no absolute values for parent ability or item difficulty, there was a low probability that the majority of these parents expressed affirmative views of their involvement in their child's education.

Conclusion

Investigating parent views of their involvement in their child's education is important for understanding how students, parents and teachers can work in concert to improve the student's learning. The equity in the three-way partnership relies on mutual respect and understanding. Consequently, investigating the effectiveness of the partnership requires collection of data from all three partners about the other two partners. This study focussed on parent views of their child, the teacher and also the school.

While the research contributes to knowledge about parental involvement, it requires confirmation by complementary studies eliciting student and teachers views of parental involvement.

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Appendix 1: Uncentralised thresholds

Item	Mean	Thresholds		
		1	2	3
1	1.10	-0.03	1.45	1.87
2	0.53	-1.99	1.20	2.37
3	0.78	-1.74	1.10	2.99
4	-0.21	-3.17	-0.18	2.72
5	-0.16	-2.77	-0.19	2.49
6	-0.62	-3.37	-0.63	2.13
8	0.83	-1.43	1.30	2.62
9	0.63	-2.02	0.67	3.23
10	-0.23	-3.01	-0.05	2.37
11	-0.31	-3.27	-0.08	2.43
12	-0.09	-2.26	-0.18	2.15
14	-0.32	-2.67	0.19	1.51
16	-0.19	-2.42	0.07	1.79
18	-0.26	-2.82	-0.16	2.20
20	0.13	-1.98	0.54	1.82
21	0.58	-1.49	1.37	1.87
22	0.26	-2.51	0.56	2.74
23	-0.36	-3.14	-0.17	2.23
24	-1.05	-3.31	-0.73	0.90
26	-0.31	-3.26	0.30	2.04
30	-0.35	-2.66	-0.15	1.76
31	-0.82	-3.06	-0.79	1.41
32	0.43	-1.93	1.20	2.02

Note: Item labels are from the original 40-item instrument.

Appendix 2: Individual item fit statistics for the 23 item data

Item	Location	SE	Residual	DegFree	DatPts	Chi Sq	Prob	degF
1	1.10	0.05	-0.12	1562.9	1637.0	4.84	0.85	9.00
2	0.53	0.05	-0.10	1562.9	1637.0	5.75	0.77	9.00
3	0.78	0.05	-1.30	1562.9	1637.0	13.59	0.14	9.00
4	-0.21	0.04	-1.88	1562.9	1637.0	26.52	0.00	9.00
5	-0.16	0.04	-0.94	1562.9	1637.0	12.33	0.20	9.00
6	-0.62	0.04	0.65	1562.9	1637.0	13.57	0.14	9.00
8	0.83	0.05	0.42	1562.9	1637.0	27.33	0.00	9.00
9	0.63	0.05	0.41	1562.9	1637.0	12.13	0.21	9.00
10	-0.23	0.04	-2.16	1562.9	1637.0	11.96	0.22	9.00
11	-0.31	0.04	-1.45	1562.9	1637.0	25.35	0.00	9.00
12	-0.09	0.04	-0.27	1562.9	1637.0	7.59	0.58	9.00
14	-0.32	0.04	-1.88	1562.9	1637.0	4.13	0.90	9.00
16	-0.19	0.04	-0.18	1562.9	1637.0	15.81	0.07	9.00
18	-0.26	0.04	-0.69	1562.9	1637.0	8.77	0.46	9.00
20	0.13	0.04	1.94	1562.9	1637.0	15.35	0.08	9.00
21	0.58	0.05	2.28	1562.9	1637.0	32.60	0.00	9.00
22	0.26	0.05	-2.35	1562.9	1637.0	14.13	0.12	9.00
23	-0.36	0.04	-2.64	1562.9	1637.0	11.25	0.26	9.00
24	-1.05	0.04	1.10	1562.9	1637.0	13.18	0.15	9.00
26	-0.31	0.05	-0.57	1562.9	1637.0	10.44	0.32	9.00
30	-0.35	0.04	-1.56	1562.9	1637.0	3.47	0.94	9.00
31	-0.82	0.04	0.58	1562.9	1637.0	4.47	0.88	9.00
32	0.43	0.05	0.45	1562.9	1637.0	33.40	0.00	9.00

Note: Item labels are from the original 40-item instrument.

Appendix 3: RUMM item map

LOCATIONION	PERSONS	ITEMS [locations]
	Affirmative parents	Difficult items
1.0		01
	X	08
	XX	09 03
	XXX	32 02 21
	XXXX	22
0.0	XXXXX	20
	XXXXXXXX	16 05 12
	XXXX	23 30 14 26 11 18 10 04
	XXXXXXXXXXXXXXXX	
	XXXXXXXXXXXXXXXX	06
-1.0	XXXXXXXXXX	31
	XXXXXXXXXXXXXXXXXXXXXXXX	24
	XXXXXXXXXXXXXXXXXXXXXXXX	
	XXXXXXXXXX	
	XXXXXXXXXXXXXXXXXXXXXXXX	
-2.0	XXXXXXXX	
	XXXXXXXXXXXXXXXXXXXXXXXX	
	XXXXXXXX	
	XXXXXXXX	
	XXXXXXXXXXXXXXXXXXXX	
-3.0	XXXXXX	
	XXXX	
	XXXX	
	XXXXXX	
	XXX	
-4.0	XXX	
	XX	
	XXX	
-5.0		
	XX	
	X	
-6.0		
	Less affirmative parents	Easy items
	X = 8 Persons	

Appendix 4: RUMM item map including uncentralised thresholds

LOCATIONION	PERSONS	ITEMS [uncentralised thresholds]
	Affirmative parents	Difficult items
3.0		09.3
		03.3
		08.3 04.3 22.3
		11.3 05.3
		18.3 23.3 02.3 10.3
2.0		32.3 26.3 06.3 12.3
		20.3 21.3 01.3
		30.3 16.3
		31.3 01.2 14.3
		02.2 08.2 21.2
1.0		03.2 32.2
	X	24.3
	XX	09.2
	XXX	20.2 22.2
	XXXX	26.2
0.0	XXXXX	16.2 14.2
	XXXXXXXXX	05.2 04.2 12.2 23.2 18.2 30.2 11.2 10.2 01.1
	XXXXX	
	XXXXXXXXXXXXXXXXX	
	XXXXXXXXXXXXXXXXX	31.2 24.2 06.2
-1.0	XXXXXXXXXX	
	XXXXXXXXXXXXXXXXXXXXX	
	XXXXXXXXXXXXXXXXXXXXX	
	XXXXXXXXXXXX	21.1 08.1
	XXXXXXXXXXXXXXXXXXXXX	03.1
-2.0	XXXXXXXXXX	02.1 20.1 32.1
	XXXXXXXXXXXXXXXXXXXXX	09.1
	XXXXXXXXXX	12.1
	XXXXXXXXXX	22.1 16.1
	XXXXXXXXXXXXXXXXXXXXX	05.1 14.1 30.1
-3.0	XXXXXXXXXX	18.1
	XXXX	04.1 23.1 31.1 10.1
	XXXX	06.1 24.1 11.1 26.1
	XXXXXX	
	XXX	
-4.0	XXX	
	XX	
	XXX	
-5.0		
	XX	
	X	
-6.0		
	Less affirmative parents	Easy items
	X = 8 Persons	