

Paper code: CAV 04446

***DEVELOPMENT OF A RASCH MODEL SCALE TO MEASURE TEACHER
OBSERVATIONS OF HOW PRINCIPALS LEAD THE SCHOOL PEDAGOGY***

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Paper presented at the 2004 Annual Conference of the Australian Association for Research in
Education: Melbourne

The research was conducted as part of an Australian Research Council funded Linkage Project
between Curtin University of Technology and the Canning Education District

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Abstract

Pedagogic leadership was defined as the leadership of teaching and learning that is exercised within a socio-political context. It was conceptualised to comprise five dimensions: developing a shared sense of educational purpose; improving teacher pedagogic practice; developing school culture; engaging staff; and committing to mission realisation. A Likert scale survey was administered to 208 teachers in 25 Western Australian schools to collect ordinal data on their observations of the principal's behaviours. Rasch model rating scale analysis was used to calibrate leadership behaviour (items) and individual teacher observations (persons) on the same interval-level scale. Examination of item 'difficulties' showed common and uncommon principal behaviours. The report explains the theoretical orientation of the study, describes how the data were analysed, and profiles the pedagogic leadership behaviours of principals as observed by teachers.

DEVELOPMENT OF A RASCH MODEL SCALE TO MEASURE TEACHER OBSERVATIONS OF HOW PRINCIPALS LEAD THE SCHOOL PEDAGOGY

Introduction

This study was a preliminary phase in an Australian Research Council (ARC) funded project into school principal leadership in the Canning Education District of Western Australia. The aim was to develop a survey-type instrument to elicit teacher observations of the leadership displayed by school principals. The development process intended to produce an interval-level scale that would eventually be suitable for administration throughout the District. In order that it would have the capacity to profile principal leadership in all schools, the scale comprised a large number of items eliciting information on multiple aspects of leadership. Whilst the measurement properties of the scale and individual items were important, the range of leadership attributes being measured was equally important. Consequently, the number of items in the instrument was relatively large and a balance was struck between ensuring accurate measurement and scale content validity. Optimal compliance with these two requirements will be exercised when data is subsequently obtained from the target (District-wide) population.

Another consideration in the design of the instrument was the choice of educational leadership approach applied in the study. A behavioural approach was chosen so that the items in the scale would concern principal behaviours considered to be directly observable by teachers. Although the study drew upon assertions about educational leadership functions and processes, the scale required that teacher respondents reflect upon their observations of the principal's actions.

This report commences with an examination of school leadership and educational change through a brief discussion of school leadership and pedagogic leadership.

Background

School leadership

Until the mid-late 1980's, the traditional approach to leadership and its study in Australian schools centred upon teaching children and curriculum implementation. Schools were led by head-teachers. Teachers, usually male, were appointed to lead the school and the major criteria for promotion were experience and teaching competence. At this time, the State education systems were led by a Director General who was a member of the State government public service and typically hailed from an educational background. The efficiency of the system was ensured by compliance with public service regulations and in evaluating the effectiveness of the system. This process was essentially internal and in comparison with more recent times, there was little press for major change or reform. Provided schools functioned according to Departmental regulations, the principal controlled the school. In such an environment, there was little need for research into school leadership or for principals to study educational leadership in a formal sense.

The formal study of educational leadership (as distinct from the leadership of industrial, business and public service organisations) commenced in America in the 1950s. An educational administration approach applying general theories of staff management and administrative functions was used to examine the leadership of schools. The application of administrative theory drew predominantly from studies of non-educational organisations. When applied to educational systems and schools the resulting theory was "... relatively new and distinctly American" Knezevich (1962, p.4).

The grounding of educational leadership theory in theories of management, administration and the American 1950s context is significant for several reasons. First, school leadership was seen as an administrative process and was explained in terms of managing organisational behaviour. Second, schools were conceptualised as formal organisations and their operations were explained by organisational theory. Third, the training of school leaders became associated with the study of educational administration. Fourth, the social institution of education was scrutinised from business and managerial perspectives. As a consequence, the leadership of schools has become inextricably

linked with management functions, albeit some educational leadership theorists differentiate between management and leadership (Fullan, 2001).

Notwithstanding this influence from organisational theory on understanding school leadership, the importance of the school instructional program, teacher instruction and student learning has re-emerged in least two decades. This emphasis is often termed 'instructional leadership'. Hallinger and Murphy (1988) for example suggested three dimensions for instructional leadership. These were defining the school mission; managing the instructional programme; and promoting a positive school learning climate. Gaffney (1989) viewed it as leadership behaviours: instructional leaders devote more time to the coordination and control of the instructional programme; they buffer the instructional core of the school and establish a supportive school climate; collaborate in evaluation and goal setting; they maintain a balance between competing areas of influence; analyse decision-making processes and structure and provide resources essential for student learning; they recognise and analyse the values orientation of self and others and provide direction while recognising individuality. Scheerens and Bosker (1997, cited in Hill, 2002, p.53) identified five dimensions of instructional leadership exercised by principals. These were time devoted to educational versus administrative tasks; the head teacher as a meta-controller of classroom processes; the head teacher as a quality controller of classroom teachers; the head teacher as a facilitator of work-oriented teams; and the head teacher as an initiator and facilitator of staff professionalization. Although all these conceptions of instructional leadership have elements concerning instruction and leadership, these two elements are respectively supplemented by a variety of other elements. If a synthesis of all the elements were produced, the result would be complex and describe a range of leadership attributes not specifically related to student instruction or to schools. The point here is that while the notion of instructional leadership has utility in drawing attention to an aspect of school leadership that is different from the leadership of other organisations, the imprecision in defining the notion itself diminishes the utility of the concept.

In light of these historical influences, it may therefore appear difficult to produce an accurate, unique and encompassing description of school leadership. One way forward is to examine a framework of school leadership developed by Sergiovanni in 1984. He identified and defined multiple school leadership dimensions as 'leadership forces' (leader and follower behaviours) - technical, human, educational, symbolic, and cultural forces. The *technical force* describes the management functions espoused by the proponents of 'classical' management theory- for example, planning, organising, staffing, directing, coordinating, reporting and budgeting. The *human force* concerns supporting people, encouraging professional growth and building morale. This is similar to the management ideology of human relations. The human relations approach to management requires a 'participatory' or 'democratic' management style by managers who are skilled in working with people. Sergiovanni (1984, p.6) described the *educational force* as "...expert knowledge about matters of education and schooling" and in so doing, highlighted the necessity for school leaders to possess and apply specialised knowledge about student instruction. The *symbolic force* focuses on the rituals and icons that symbolise what is valued within the school to provide a sense of direction. The final dimension, the *cultural force*, involves building a sense of community within the school so that staff are united and believe in the school as an essentially ideological system. The order of the five forces in this explication is significant. Sergiovanni (1984) considered that whilst some or all five forces are present in particular schools, 'excellence' in leadership will be evidenced by the presence of the latter two forces – the *symbolic* and *cultural* forces. From a perspective of leadership theory, the framework may be seen to acknowledge the management aspect of school leadership (technical and human forces), the instructional role of school leaders (educational force), and perhaps most significantly, provided a foundation for future theorising and research into ethical, moral and cultural leadership in schools (symbolic and cultural forces).

Notwithstanding Sergiovanni's (1984) recommendations, since the mid-1980's there has been strong press for educational and school reform - increased efficiency and effectiveness. The demand for improved efficiency in schools and systems has resulted in the application of business models of management and change based on the principles of corporate managerialism, sometimes termed

New Public Management in Australia (Gronn, 2003, p.67). State Education Departments were made more accountable to government, schools and principals were held more accountable by the educational system, the Directors-General lost parts of their independence, and degrees of local community/parental involvement in school governance became mandated. The requirement to demonstrate effectiveness has subsequently led to increased emphasis on students attaining centrally prescribed educational outcomes and principals being held accountable for these outcomes. Ironically for principals, educational accountability increased concurrently with accountability for change of management and organisational practices. Balancing the administrative role with the curriculum/instructional role has therefore become a major challenge of the principalship. Murphy and Hallinger (1992) questioned the notion of balancing and considered that it was impossible for one person to give adequate attention to both roles. They viewed the capacity of principals to effect both pedagogic and organisational improvement as contingent on the individual principal's professional knowledge. That is, an understanding of teaching and learning, *and* of the theories and processes of educational change. These matters are addressed in the following sections.

Pedagogic leadership

The term pedagogy originated in ancient Greece and referred to the teaching of children. Recently, MacNeill, Cavanagh and Silcox (2003) noted that in the last decade the notion of pedagogy has become used more frequently by educators and educational theorists in four interrelated ways. These are: an inclusive view of all aspects of teaching (Mortimore, 1999; Newmann & Associates, 1996); a student-teacher relationships (van Manen, 1999); student centred learning (Hamilton & McWilliam, 2001); and, a political tool for the enculturation of children (Freire, 1977; Smyth, 1985; van Manen, 1999). According to these conceptions, instruction is not viewed as synonymous with teaching, but alternatively is only one aspect of teaching (Mortimore, 1999; Newmann & Associates, 1996). As well, student centred learning has been differentiated from didactic teaching (Hamilton & McWilliam, 2001). For the purposes of this study, pedagogy is viewed to encompass a variety of teaching and learning methods grounded in theories of student learning and influenced by internal and external socio-political contexts of the school.

The arena in which pedagogic leadership is exercised comprises the school social and political environments as characterised by the school's culture. Pedagogic leaders need to be aware of the culture of learning and teaching in the school and understand how prevailing educational value and belief systems affect learning and teaching processes. However, the school socio-political environment and indeed the culture are rarely static due to pressure from forces within the school and external to the school (Cavanagh & Dellar, 2003). When principals direct their professional efforts towards improving the school pedagogy, these efforts will be ameliorated by the intrinsically dynamic nature of the school culture. Consequently, effecting improvement of the school pedagogy requires concomitant attention to the cultural and temporal contexts of pedagogy. The level of success in effecting pedagogic improvement is dependent upon maintaining sharp focus on this goal and being resolute and determined in working towards this goal (Silcox, Cavanagh & Dellar, 2003).

Summary

From the preceding, five attributes may be proposed as constituting the concept of principal leadership of school pedagogy. The first is leadership vision or sense of mission about the learning of children. The second is a focus on school-level activities, specifically the work of teachers. The third is the importance of school culture as a mediating factor in educational change and effective student learning. Fourth, is the engagement of teachers to increase their commitment to students and to the school. Last, is steadfast principal leadership dedicated to meeting the educative needs of students.

Objectives

The study sought to apply the Rasch Model to construct an interval-level scale to measure teacher observations of school principal's behaviours in leading school pedagogy. Scale development was based upon a hypothesised model comprising five behavioural dimensions of principal leadership. Specifically, the study aimed to apply a scale development process to produce a scale that:

1. Measured teachers teacher observations of principals' behaviours in leading school pedagogy;
2. Calibrated item difficulties and teacher-reported principal behaviours on the same scale; and
3. Elicited data to fit the theoretical model.

Theoretical framework

The subject of study was a trait, a relatively enduring characteristic of individuals that is evidenced by a certain manner of response or behaviour(s) in all situations. The trait investigated was principal leadership of pedagogy - principal capacity for improving the quality of teaching and learning within the school. This trait was assumed to be latent and not directly observable, but could be indicated by observation of particular behaviours. In this study, the behaviours needed to be sufficiently overt to be observable by teachers. The choice of teacher observations as a source of data to indicate a trait of principals was considered more valid and reliable than principal self-reported information. However, in limiting the teacher data to observed behaviours, the empirical results of the study were restricted to providing a descriptive view of the leadership trait rather than providing inferential information about the reasons for the behaviours (attitudes, dispositions or motivation). These methodological issues influenced development of the preliminary theoretical framework, particularly the terminology applied to describe the components within the framework (see Figure 1).

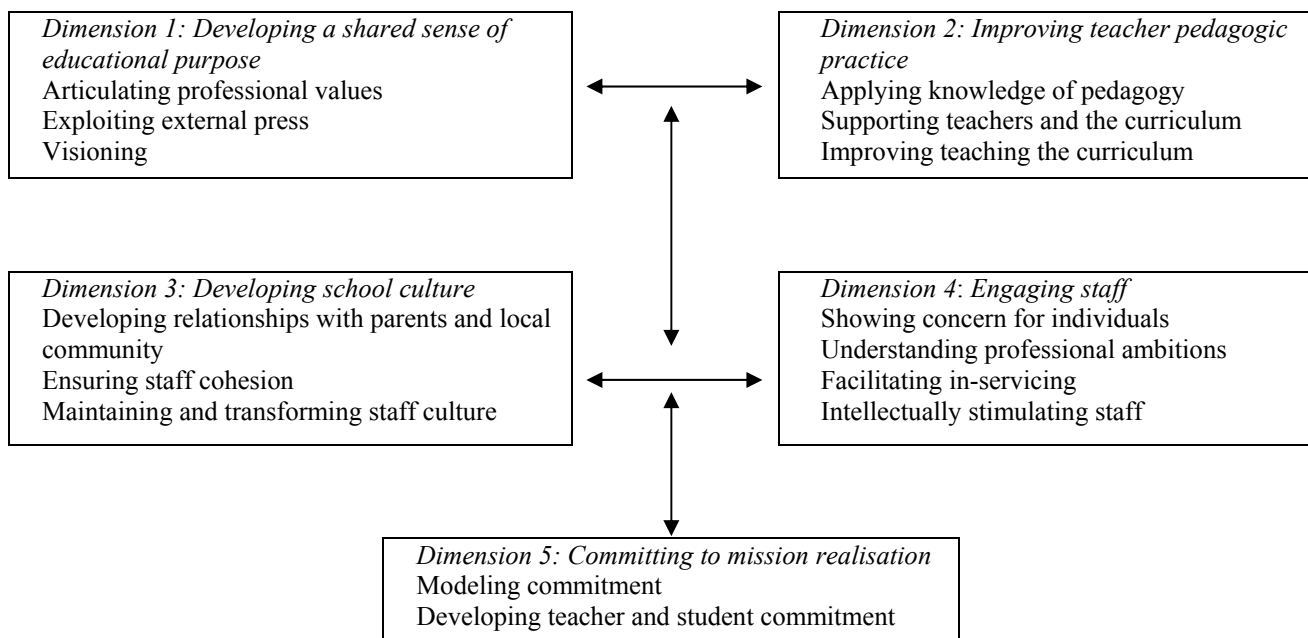


Figure 1: Hypothesised model of principal pedagogic leadership behaviours

The theoretical framework comprised the five dimensions previously proposed as the attributes of principal pedagogic leadership. These were: developing a shared sense of educational purpose; improving teacher pedagogic practice; building school culture; engaging teachers; and committing to mission realisation. Each dimension was defined by specifying two or more unique activities to exemplify the five core constructs comprising the leadership trait. For example,

developing a *shared sense of educational purpose* was considered to involve three activities - *articulating professional values*, *exploiting external press* and *visioning*. In this example, the core activity is the principal espousing rationales for education in order to unite teachers through development of a common understanding of the school's current and future mission. Specifically, by explaining to teachers what he/she values as an educator, examining prevailing value systems about schooling to justify change, and then collaborating with teachers to formulate a vision of the school's future. The five dimensions were expected to be mutually influential with the actions of the principal within one dimension anticipated to have an effect on actions within all the other dimensions. The double arrows in the framework indicate hypothesised mutual dependency between dimensions.

The framework constitutes more than a diagrammatic representation of core constructs and relationships however. The components within the framework provided a conceptual structure for instrument development and item writing. Also, the framework is a conceptualisation of a leadership trait - a theoretical model that could be empirically tested with the intent of statistical validation.

Research methods

The development of the scale and the testing of the conceptualisation of the latent trait used Rasch Model analyses (Rasch, 1960/1980). The decision to use probabilistic analytic techniques rather than classical (inferential) techniques was due to the research objective of producing an interval-level scale. Implicit in this objective is the necessity for compliance with stringent measurement requirements. That is to say: the need for dimensionality - the data measures a single or dominant trait; qualification - data can be compared; quantification - variables are measured in common units; and linearity - data to is positioned on a line or scale (Wright & Masters, 1982; Wright, 1999). Rasch Model analysis was also essential for attaining the second research objective - calibrating item difficulties (item measures) and teacher-reported principal behaviours (person measures) on the same scale.

The research design comprised hypothesis formulation (proposal of a preliminary theoretical model), instrument construction (item writing and testing), and then hypothesis (model) testing by Rasch analysis. The Rasch Unidimensional Measurement Model (RUMM) computer program (Andrich, Sheridan, Lyne & Luo, 2000) was used for all data analyses. Apart from the utility of RUMM for rating scale analysis, the program is ideal for item-bank development. RUMM can simultaneously process data from multiple instruments obtained from different samples, provided data from common items is collected from the majority of respondents. Another feature of RUMM is the absence of a minimum ratio of the number of items to the sample size. Only a minimum number of items (>10) and minimum sample (>100) are required. This can be contrasted with factor analytic methods typically requiring an item to sample ratio of 1:5 and a large sample to ensure accurate estimation of correlation and covariance.

Three surveys were constructed containing a total of 165 items of which 110 common items were included in each of the three surveys. The other 55 items were evenly distributed across the three surveys. The surveys were completed by a convenience sample of 208 teachers from 25 primary and secondary schools. The teachers responded to the items on a four point Likert scale from strongly agree, agree, disagree and strongly disagree scored from 4 to 1 respectively. The three surveys were administered in each of the 25 schools. All of the surveys produced 'incomplete' data due to the difference in items comprising the three surveys. Thus when the data were entered into a spreadsheet, 'missing data' were scored as '9'.

Data were transferred into RUMM and the program was instructed to compute scores within the range from 1 to 4. Summary test-of-fit statistics were calculated for the 165 items and the separation index was computed to show the level of overall item fit to the model. This test also showed whether the low ratio of number of items to sample size ($\approx 3:4$) and the presence of 'missing data' significantly affected the capacity of RUMM to estimate data to model fit. It should be noted that factor analytic methods would not have been applicable to these data since correlation

coefficients could not be computed for all pairs of variables/items since 55 items were not common to two or more surveys.

Un-centralised item thresholds were calculated and items with disordered thresholds were identified and discarded. These items had elicited illogical or inconsistent responses from the teachers. Data from items with ordered thresholds were retained for further analysis. The criteria for further instrument refinement included retaining items with low residuals. The residual for an item is the difference between the actual teacher responses and the expected responses, as specified by the model. A low residual value ($< \pm 2.0$) shows the data for an item fit the model well. Also, items with high Chi Square probability values were retained. The Chi-square test estimates the probability that an item's data fit the model and a low probability value ($p < 0.05$) shows the fit is poor. The semantics of items that met these statistical criteria were then considered to identify items that were conceptually logical. These items were retained and then RUMM summary test-of-fit statistics were calculated to show the extent to which the retained data fitted the conceptual model.

The remaining items were again examined for semantic content and then organised into five groups in accord with the classification system used in the initial conceptualisation of principal pedagogic leadership. Sub-groups of items were also identified. Individual item-fit statistics were calculated to show item locations as measured in logits (logarithmic units based on the logarithmic odds of answering positively). The items, item groupings, item sub-groupings, and item locations (logits) were then presented in tabular form as the refined scale.

Finally, the location of items within the groups and sub-groups of items were compared to show the relative 'difficulty' (location) of items in the refined scale. The 'difficult' items were those that the respondents viewed as being uncharacteristic behaviour of the principal (i.e. the level of affirmation of these behaviours was comparatively low). In contrast, the 'easy' items were associated with more common or prevalent leadership behaviours.

Results

Summary test-of-fit statistics were calculated for the 165 items, the separation index of 0.95 showed a good fit between the items and the model. However, when un-centralised item thresholds were calculated for the 165 items, 18 items were found to have disordered thresholds and so these items were discarded. Also, of the remaining 147 items, 54 items did not fit the model well as shown by low chi square probabilities (< 0.05) or high residuals ($> \pm 2.0$). These items were discarded.

Individual item-fit statistics (location, residual and chi square probability) were calculated for the remaining 82 items (see Appendix 1). The item locations ranged from -2.04 to +1.51 showing there was a range of difficulties within the items. The majority of the chi square probabilities were greater than 0.05 and the residuals were generally lower than ± 2.0 showing that the fit of the majority of the items to the model was good.

To show the overall fit between persons and items a RUMM item map was generated (see Appendix 2). The distribution of person locations matched the distribution of item location quite well showing that the items 'targeted' the sample. The majority of the persons were located between +5.0 logits and -4.0 logits while the majority of the items were located within a smaller range of logits (+4.0 to -4.0).

Summary test-of-fit statistics were calculated to test the data to model fit (see Table 1). The item-person interaction indicates the degree to which teachers answer items of different 'difficulty' in a logical and consistent manner. When the data fits the model, the fit statistic has a mean near zero and a standard deviation near 1. A negative fit statistic indicates that data fitted the model very closely. A positive fit statistic indicates that some 'noise' is present. In this case the means of 0.00 and 1.10 indicate the teachers were logical and consistent in their responses to items of different 'difficulty'. The standard deviations of 0.74 and 1.77 indicate the variance in item data was acceptable but variance in teacher data was somewhat lower than would be observed in an ideal data to model fit. For item-trait interaction, the total Chi-square probability was 0.14 ($p > 0.05$). This result indicates that for these data, the scale was measuring a dominant and possibly uni-

dimensional trait. The proportion of observed variance considered true should be close to 1. For these data the proportion of observed variance considered true (a Cronbach Alpha) could not be estimated since correlation coefficients could not be computed for all pairs of items. The power of the test-of-fit statistic showed the overall fit between the data and the model was excellent with a separation index of 0.98.

Table 1
Summary of Rasch psychometric statistics for the 82 item scale of teacher perceptions of principal leadership of school pedagogy (n = 208)

Item-Person Interaction

	Items		Teachers	
	Location	Fit Statistic	Location	Fit Statistic
Mean	0.00	- 0.17	1.10	-0.59
SD	0.74	1.13	1.77	2.36

Item-Trait Interaction

Total Item Chi Sq	183.7
Total Degree Freedom	164.0
Total Ch Sq Probability	0.14

Proportion of observed variance (a Cronbach Alpha) considered true for the scale could not be calculated

Power of Test-of-Fit

Power is EXCELLENT
 (Separation Index of 0.98)

The refined scale of 82 items is presented in Appendix 3. The items are organised into five groups consistent with the original conceptualisation of principal pedagogic leadership. The location of each item as measured in logits, has been included to show the relative level of perceived prevalence of the leadership attributes measured by the scale.

Discussion of results

The empirical findings of the study can be interpreted in two ways. The first consideration is the utility of the analytic methods for scale development and the second consideration is the meaning of the scale as shown by the analysis results.

Scale construction and testing

The proven capacity of RUMM to process data from a small sample (n = 208) for a comparatively large number of items (165) distributed across three surveys is significant. Irrespective of the time and attention given to scale conceptualisation, item writing and pilot studies, the validity and reliability of the scale can only be tested through psychometric analysis of data. When complex problems such as understanding school leadership are investigated using rating scale surveys, a large pool of items usually needs testing and obtaining a big sample to trial this many items can be difficult. While data with a small sample size to number of items ratio can be analysed, obtaining good data to model fit will also be dependent upon the quality of the items and the internal coherence of the scale. The items and the scale need to invoke logical and consistent responses from the respondents. The point here is that the utility of RUMM analysis will not

compensate for poor item writing and when a large number of items are being tested, the semantics of all items is crucial. Indeed, if a large proportion of the items do not accurately target the trait being investigated, these items could be 'statistically fitted' to a model of a different trait resulting in the scale lacking content validity. In the case of this study of principal pedagogic leadership, the majority of the items fitted the model as originally conceptualised and this result justified proceeding with scale refinement and provided confidence in the content validity of the refined scale.

The meaning of the scale

The Rasch transformation calibrated items and teachers on the same scale. Consequently, the locations of the individual items within the scale, the item logits, provide a standardised measure of teacher perceptions of multiple dimensions in the pedagogic leadership of their principals. Comparing the logits for data from the different groups of items shows which aspects of principal leadership behaviours were perceived as relatively common or uncommon in the 25 schools investigated. The negative logits in Appendix 3 indicate common leadership behaviours whereas the positive logits indicate uncommon behaviours. In the following discussion, the meaning of the scale is based on logits for the five groups and respective sub-groups of items. To simplify the discussion by avoiding repetition, the linkage between the source of data (teacher observations) and principal behaviour(s) is not mentioned. Alternatively, the teacher observations are reported as demonstrated principal behaviours.

The first group of items elicited data on *developing a shared sense of educational purpose*. When *articulating professional values*, the principals commonly expressed that the school and education were important, but questioning this value and behaving in a manner commensurate with the value were less common. *Exploiting external press* commonly involved using evidence of requirements imposed from outside the school to garner support for change within the school, but it was less common to for the principal to gauge the effectiveness of current programs in terms of these external requirements. The *visioning* process was commonly based upon the principal's own values and vision. Teachers had limited involvement in the process, the principal was infrequent in encouraging them to express their views, and teachers were not often provided with a choice between alternative scenarios of the school's future. These results show that developing a sense of educational purpose within the schools was predominantly a principal-centred activity in which the principal shared his/her values and expectations with teachers with limited teacher input. The results also question the extent to which the sense of educational purpose was a 'shared' understanding that reflected the expectations of the staff.

The second group of items concerned *improving teacher pedagogic practice*. The principals applied a *knowledge of pedagogy* as demonstrated by their expectations of teaching and learning, the school's curriculum and of the learning environment. However, the principals' expectations of an outcomes-based approach from teachers in designing instruction and in using pedagogic theory to justify the school's instructional program were less frequently demonstrated. *Supporting teachers* was evidenced by principals recognising the work of teachers in creating positive classroom learning environments and also by expressing confidence in the competence of teachers. The influence of principals on *improving teaching* by talking with individual teachers about their teaching, providing timely and relevant advice on improving teaching, and observing teachers at work in the classroom, was not revealed as common. With regard to *supporting and improving the curriculum*, the principals ensured compliance with local curriculum policies, considered the school's curriculum was meeting student needs, and convened meetings about student assessment and reporting. However, they gave less attention to deliberations concerning the sequencing and balance of the instructional program. The general view obtained from the empirical results concerning pedagogy within the schools is that while the principals were actively involved in many aspects of teaching and learning, they had a limited influence on pedagogic change and improving the pedagogy.

The third group of items, *developing school culture* was conceptualised to include the involvement of local community members, parent/caregivers, and also the school staff in developing value and attitudinal systems. *Communicating with parents/caregivers* was a very common activity of the principals as was explaining the importance of teachers *developing partnerships with parents/caregivers* and encouraging teachers to elicit parent/caregiver involvement in their child's education. In comparison, initiating programs to develop equitable and empowering relationships with parents/caregivers was less commonly displayed. Similarly, *developing relationships with the local community* also comprised less common behaviours. The work of principals with teachers to develop school culture, *ensuring harmonious relationships within the staff, building staff culture, maintaining staff culture, and improving the staff culture* was also less frequently exhibited. In general, the principals were effective in communicating with the local community and parents/caregivers, but were less effective in building and transforming the culture of the school community. They showed a limited understanding of prevailing beliefs and values and a low disposition towards stimulating development of alternative beliefs and values.

Engaging teachers was the focus of the fourth group of items. The principals were characterised by *showing concern for individuals* and *facilitating in-servicing*. However, the other postulated aspects of engaging teachers were less characteristic. For example principals *understanding the professional ambitions* of teachers and staff groups, and *intellectually stimulating staff*. These results show the predominant way the principals elicited the engagement of staff was a combination of caring for individuals and providing them with formal training. It was not common for engagement to be elicited by using the vocational aspirations of teachers as vehicle for motivation or by arousing teacher professional inquisitiveness.

The fifth group of items concerned *committing to mission realisation*. Principal commitment to ensuring the school's mission was realised was shown by the principal modeling his/her commitment for staff and students, and then by eliciting their commitment by extrinsic motivation. *Modeling commitment* by monitoring and understanding existing programs was common. Similarly, *developing teacher and student commitment* by praise, acknowledgement and commendation were common. *Modeling commitment* by discussing re-organisation of the school, viewing potential problems as opportunities for improvement, and anticipating problems in advance were less common.

Summary

Within the results for each group of items and across all of the groups, it is possible to identify some recurrent issues:

- First, the leadership behaviours associated with maintenance of the status quo were generally more common than those associated with change;
- Second, principals gave more emphasis to their own the beliefs and values than to the beliefs and values of other members of the school community;
- Third, understanding pedagogy was displayed in terms of prevailing theory, practice and curriculum provision in contrast to a more 'critical' view of pedagogy;
- Fourth, to engage teachers, the principals applied personal and organisational approaches rather than 'professional' approaches that acknowledge teacher aspirations and teacher capacity for informed critique; and
- Finally, understanding the culture of the school and how to manage the culture were not commonly demonstrated.

Conclusion

From a research methods perspective, the study has shown how application of the Rasch model by using RUMM analyses enables data from a large number of items and a comparatively small sample to be analysed.

From a theoretical perspective, the Rasch analysis validated a theoretical model of principal leadership of pedagogy. This comprised five behaviours: developing a shared sense of educational

purpose; improving teacher pedagogic practice; developing school culture; engaging teachers; and committing to mission realisation. In terms of educational leadership theory, the study has investigated an important aspect of the leadership role of school principals - their influence on learning and teaching within the school.

From a pragmatic perspective, examination of item locations showed the dimensions of pedagogic leadership that were observed by teachers to be more frequently displayed by the principal. Hence the empirical findings of the study have application in school principal leadership preparation and incumbent principal in-service.

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APPENDIX 1: INDIVIDUAL ITEM-FIT STATISTICS

Item	Location	SE	Residual	DegFree	DatPts	Chi Sq	Prob
Group 1. Developing a shared sense of educational purpose							
<i>Sub-group: Articulating professional values</i>							
25	-0.96	0.13	-1.19	192.9	200	0.86	0.65
102	-1.29	0.14	0.16	190.0	197	0.04	0.98
105	0.58	0.12	1.18	183.2	190	3.09	0.21
108	0.61	0.14	1.48	175.5	182	6.26	0.04
109	0.37	0.13	0.17	179.4	186	1.53	0.47
<i>Sub-group: Exploiting external press</i>							
37	-0.38	0.13	0.50	189.0	196	0.22	0.90
38	0.00	0.13	0.41	187.1	194	2.12	0.35
39	-0.04	0.13	-1.25	186.1	193	2.50	0.29
<i>Sub-group: Visioning</i>							
21	-0.75	0.12	0.65	192.9	200	0.95	0.62
55	0.40	0.11	-1.00	187.1	194	0.44	0.80
61	-0.29	0.12	0.15	192.9	200	1.25	0.54
63	0.33	0.11	-1.71	191.9	199	1.49	0.48
64	0.05	0.11	-0.71	190.0	197	4.65	0.10
Group 2. Improving teacher pedagogic practice							
<i>Sub-group: Applying knowledge of pedagogy</i>							
74	-0.03	0.12	-0.85	191.9	199	1.20	0.55
76	0.18	0.12	1.13	189.0	196	2.18	0.34
77	-0.30	0.13	0.35	191.9	199	2.04	0.36
80	0.38	0.12	-1.04	188.1	195	1.28	0.53
81	-0.23	0.12	-0.50	192.9	200	2.43	0.30
83	-1.25	0.14	-1.57	193.8	201	2.48	0.29
85	0.01	0.12	-0.15	190.9	198	0.62	0.73
<i>Sub-group: Supporting teachers</i>							
82	-1.08	0.13	-1.98	193.8	201	3.11	0.21
86	-0.34	0.12	-1.04	190.9	198	4.13	0.13
<i>Sub-group: Improving teaching</i>							
41	0.83	0.11	-0.25	190.0	197	7.82	0.02
42	1.51	0.11	1.88	190.0	197	1.81	0.41
43	1.34	0.12	-0.51	188.1	195	1.15	0.56
45	1.21	0.11	-0.91	189.0	196	1.59	0.45
<i>Sub-group: Supporting the curriculum</i>							
92	-1.33	0.13	-0.16	190.9	198	0.91	0.63
93	-0.24	0.13	2.01	187.1	194	15.78	0.00
<i>Sub-group: Improving the curriculum</i>							
78	-0.08	0.12	0.07	190.0	197	2.43	0.30
79	0.34	0.12	-0.69	189.0	196	2.70	0.26
Group 3. Developing school culture							
<i>Sub-group: Communicating with parents/caregivers</i>							
111	-2.04	0.27	-0.71	64.6	67	0.49	0.78
112	-1.57	0.24	0.07	62.7	65	1.23	0.54
113	-1.68	0.25	-0.21	64.6	67	0.50	0.78
114	-0.50	0.21	-1.09	62.7	65	2.57	0.28

Sub-group: Developing partnerships with parents/caregivers

116	-0.33	0.23	-0.88	62.7	65	0.90	0.64
117	-0.27	0.22	-0.81	64.6	67	1.64	0.44
118	-0.73	0.23	-1.34	64.6	67	1.59	0.45
119	0.66	0.21	-0.97	61.7	64	1.02	0.60
120	0.78	0.22	-0.55	61.7	64	0.69	0.71

Sub-group: Developing relationships with the local community

121	-0.36	0.22	0.53	63.7	66	1.61	0.45
122	0.55	0.22	0.00	62.7	65	0.23	0.89
123	1.14	0.20	1.64	61.7	64	2.66	0.26
124	0.76	0.21	-0.90	60.8	63	1.22	0.54
125	0.89	0.20	1.43	58.8	61	3.85	0.15

Sub-group: Ensuring harmonious relationships within the staff

8	1.17	0.12	0.93	175.5	182	0.79	0.68
9	1.20	0.12	0.35	175.5	182	0.31	0.86

Sub-group: Building staff culture

151	0.14	0.20	0.00	59.8	62	2.19	0.34
153	0.36	0.21	-1.08	60.8	63	3.00	0.22
155	0.23	0.20	-0.83	60.8	63	3.21	0.20

Sub-group: Maintaining staff culture

156	-1.24	0.27	0.83	59.8	62	1.13	0.57
158	0.55	0.21	-1.86	59.8	62	1.21	0.55
159	0.30	0.22	-1.23	57.9	60	1.53	0.47
160	0.59	0.20	-1.94	60.8	63	0.94	0.62

Sub-group: Improving the staff culture

163	0.32	0.22	-2.43	57.9	60	2.97	0.23
164	0.20	0.24	1.13	55.0	57	1.26	0.53

Group 4. Engaging staff

Sub-group: Showing concern for individuals

1	-0.51	0.12	1.02	196.7	204	0.82	0.67
2	-0.41	0.12	1.01	197.7	205	2.79	0.25
4	0.48	0.11	2.85	191.9	199	6.19	0.05

Sub-group: Understanding professional ambitions

11	0.35	0.11	-0.61	190.9	198	0.43	0.81
12	0.46	0.11	-1.32	187.1	194	0.22	0.90
13	0.89	0.12	-1.63	184.2	191	3.56	0.17

Sub-group: Facilitating in-servicing

33	-0.58	0.12	-0.12	191.9	199	0.45	0.80
34	-0.11	0.12	-0.58	191.9	199	0.33	0.85

Sub-group: Intellectually stimulating staff

48	0.38	0.12	0.27	188.1	195	0.46	0.80
49	0.42	0.12	-0.45	187.1	194	0.25	0.88
50	0.28	0.11	-1.08	189.0	196	0.70	0.70
56	-0.20	0.13	1.43	183.2	190	2.88	0.24
57	-0.60	0.13	-1.34	185.2	192	3.74	0.15
58	0.07	0.13	-1.37	181.3	188	1.05	0.59
59	1.27	0.13	0.92	179.4	186	3.00	0.22

Group 5. Committing to mission realisation

Sub-group: Modeling commitment

24	-1.16	0.13	-0.78	195.8	203	1.62	0.44
26	-0.58	0.12	1.29	195.8	203	0.45	0.80
68	-0.51	0.12	-0.61	193.8	201	0.83	0.66
97	-0.02	0.12	3.14	189.0	196	21.34	0.00
98	0.33	0.12	0.24	189.0	196	3.54	0.17
128	-0.22	0.19	0.07	67.5	70	2.77	0.25
129	0.73	0.21	-0.73	64.6	67	1.56	0.46
130	0.56	0.20	0.55	63.7	66	0.43	0.81

Sub-group: Developing student and teacher commitment

18	-0.64	0.12	-0.75	195.8	203	1.24	0.54
19	-0.19	0.12	-1.21	190.9	198	2.32	0.31
67	-0.91	0.13	1.81	193.8	201	0.73	0.69
72	-0.25	0.11	-1.09	192.9	200	2.22	0.33

Note: The item labels are according to those in the original survey as entered into RUMM

APPENDIX 2: RUMM ITEM MAP

LOCATION	PERSONS	ITEMS [uncentralised thresholds]
6.0	'High' leadership	'Difficult' items
	X	
	X	
5.0	XXX	
	X	
	X	
4.0	XX	059.3
	X	009.3 108.3 008.3
	XXX	043.3 129.3 120.3
	XXXX	124.3 123.3
	XXXXX	122.3 045.3 042.3 013.3
3.0	XXX	119.3 109.3 048.3 158.3 125.3 164.3
	XXXXXXXX	098.3 163.3 160.3 130.3
	XXX	159.3 038.3 039.3 097.3 079.3 049.3 041.3 080.3 058.3 153.3
	XXXXXXXXXX	093.3 076.3 117.3 116.3 055.3 012.3 077.3 004.3 105.3
	XXXXXXXXXX	037.3 118.3 155.3 085.3 011.3 078.3 056.3 121.3
2.0	XXXXXX	074.3 151.3 081.3 063.3 050.3
	XXXXXXXXXXXXXXXX	128.3 001.3 034.3 057.3 156.3 064.3 086.3 112.3 019.3
	XXX	111.3 033.3 061.3 114.3 018.3
	XXXXXXXXXX	059.2 092.3 025.3 042.2 102.3 043.2 021.3 002.3
	XXXX	082.3 072.3 068.3 026.3
1.0	XXXXXXXXXXXXXXXX	113.3 083.3
	XXXXXXXXXXXXXXXX	045.2 122.2 013.2 024.3 123.2 159.2 067.3
	XXXXXXXXXXXXXXXXXXXXXXXX	164.2 105.2 041.2
	XXXXXXXXXX	008.2 108.2 009.2 124.2 119.2
	XXXXXXXXXXXXXXXX	158.2 080.2 129.2 130.2 109.2 076.2 004.2 125.2
0.0	XXXXXXXXXX	120.2 012.2 155.2 097.2 049.2 163.2 079.2
	XXXXXXXXXX	058.2 011.2 050.2 055.2 048.2
	XXXXXXXXXX	074.2 063.2 042.1 085.2 098.2
	XXXXXX	038.2 021.2 034.2 045.1 019.2 039.2 153.2 078.2 061.2 064.2
	XX	009.1 002.2 160.1 151.2 114.2 093.2 128.2 072.2 121.2
-1.0	XXX	041.1 033.2 151.1 081.2 037.2 125.1 018.2 063.1 056.2 117.2
	XXX	012.1 001.2 011.1 025.2 043.1 118.2 068.2 123.1
	X	064.1 026.2 092.2 050.1 055.1 057.2 153.1 077.2 086.2 112.2
	XXXXXXXXXX	013.1 105.1 067.2 049.1 004.1 120.1 072.1
		026.1 129.1 086.1 124.1 158.1 034.1 059.1 119.1 098.1 130.1
	XXX	085.1 002.1 048.1 024.2 080.1 082.2 081.1 079.1 068.1 074.1
		061.1 156.2 078.1 067.1 056.1 102.2 163.1 038.1 083.2 019.1
	X	109.1 039.1 076.1 116.1 001.1 077.1
		082.1 108.1 113.2 114.1 093.1 037.1 057.1 117.1 122.1 033.1
	X	159.1
-3.0	X	111.2 083.1 018.1 121.1 097.1
		118.1 164.1 102.1 025.1 021.1
		113.1 156.1
	X	
-4.0		092.1
-5.0		111.1
		112.1
-6.0		
	X	
-7.0	Low leadership	'Easy' items

X = 1 Persons

APPENDIX 3: RASCH MODEL SCALE OF TEACHER OBSERVATIONS OF PRINCIPAL PEDAGOGIC LEADERSHIP

Please rate the 82 items according to the following response format and place a number corresponding to the format on the appropriate line opposite each statement:

Response categories

Strongly agree	put 4
Agree	put 3
Disagree	put 2
Strongly disagree	put 1

Group 1. Developing a shared sense of educational purpose

<i>Sub-group: Articulating professional values</i>		Logits*
102	Views the role of the school as being responsive to the educative needs of the local community	-1.29
25	Assigns high importance to the role of education in improving society	-1.19
109	Displays a personal commitment to the role of education in transforming society	+0.37
105	Is committed to changing local community beliefs and values about education	+0.58
108	Questions prevailing societal values towards education and the needs of children	+0.61
<i>Sub-group: Exploiting external press</i>		
37	Questions whether or not the school is meeting local community and societal needs	-0.38
39	Evaluates the effectiveness of current programs in light of changes external to the school	-0.04
38	Uses evidence of external changes to generate support for change within the school	0.00
<i>Sub-group: Visioning</i>		
21	Clearly explains to others what he/ she values within the school	-0.75
61	Informs teachers of his/ her vision of the school's future	-0.29
64	Ensures the school vision statement is reviewed	+0.05
63	Encourages teachers to express their own expectations of the school's future	+0.33
55	Presents teachers with scenarios of the school's future	+0.40

Group 2. Improving teacher pedagogic practice

<i>Sub-group: Applying knowledge of pedagogy</i>		
83	Emphasises the need for teachers to cater for the individual educational needs of their students	-1.25
77	Expects teachers to ensure sequential development of student knowledge, skills and attitudes	-0.30
81	Ensures classroom and school facilities are conducive to improving student learning	-0.23
74	Demonstrates knowledge of theories concerning student learning	-0.03
85	Evaluates the effectiveness of classroom environments in terms of improved student learning	+0.01
76	Requires teachers to specify learning outcomes when designing programs and planning lessons	+0.18
80	Justifies the school's instructional program in terms of theories about how children learn	+0.38
<i>Sub-group: Supporting teachers</i>		
82	Recognises the role of teaches in creating a positive classroom learning environment	-1.08
86	Expresses confidence about the instructional competence of most teachers	-0.34
<i>Sub-group: Improving teaching</i>		
41	Finds time to talk with individual teachers about their teaching	+0.83
45	Is a major influence in enabling individual teachers to be more instructionally competent	+1.21
43	Provides timely and relevant advice to individual teachers on improving their teaching	+1.34
42	Observes individual teachers at work in their classroom	+1.51
<i>Sub-group: Supporting the curriculum</i>		
92	Ensures the school curriculum is consistent with the <i>Curriculum Framework</i>	-1.33
93	Expresses confidence in the capacity of the existing school curriculum to meet student needs	-0.24
<i>Sub-group: Improving the curriculum</i>		
78	Convenes meetings to discuss how student progress will be assessed and be reported	-0.08
79	Convenes meetings to ensure the school's instructional program is sequential and balanced	+0.34

Group 3. Developing school culture

Sub-group: Communicating with parents/caregivers

111	Provides information on school programs and activities to parents/ caregivers	-2.04
113	Encourages parents/ care-givers to communicate with the school and individual teachers	-1.68
112	Provides parents/ caregivers with information on their child's progress at school	-1.57
114	Clearly and convincingly articulates the school mission to meetings of parents/ caregivers	-0.50

Sub-group: Developing partnerships with parents/caregivers

118	Explains to teachers the benefits of developing partnerships with parents/ caregivers	-0.73
116	Explains the importance of the home environment for student learning to parents/ caregivers	-0.33
117	Encourages teachers to elicit the involvement of parents/ caregivers in their child's learning	-0.27
119	Initiates programs to develop equitable partnerships with parents/ caregivers	+0.66
120	Initiates programs that empower parents/ caregivers to contribute to their child's education	+0.78

Sub-group: Developing relationships with the local community

121	Disseminates information on school programs and achievements to the local community	-0.36
122	Provides teachers with an explanation of local community needs	+0.55
124	Incorporates community needs in school planning and facilities development	+0.76
125	Receives public acknowledgment for the school's contribution to the community	+0.89
123	Organises sharing of school facilities with the local community	+1.14

Sub-group: Ensuring harmonious relationships within the staff

8	Resolves tensions or conflict arising between individuals within cliques or informal groups	+1.17
9	Resolves tensions or conflict arising between cliques or informal groups within the staff	+1.20

Sub-group: Building staff culture

151	Expresses that the beliefs and values of all teachers are of importance	+0.14
155	Develops an environment in which teachers value mutual support and professional cohesion	+0.23
153	Enables teachers to express what they value about their work and within the school	+0.36

Sub-group: Maintaining staff culture

156	Participates in ceremonies and rituals	-1.24
159	Explains to teachers what they collectively value and expect of the school	+0.30
158	Identifies what teachers collectively value and expect of the school	+0.55
160	Models and reinforces the collective values of the school's teachers	+0.59

Sub-group: Improving the staff culture

164	Challenges the beliefs and values of teachers who do not support school improvement initiatives	+0.20
163	Displays knowledge of staff beliefs and values likely to support improvement of the school	+0.32

Group 4. Engaging staff

Sub-group: Showing concern for individuals

1	Is aware of teachers requiring support in meeting their professional obligations	-0.51
2	Is available and accessible to teachers requiring support	-0.41
4	Provides support for teachers even when not support is not requested	+0.48

Sub-group: Understanding professional ambitions

11	Talks with individual members of staff and groups about their aspirations	+0.35
12	Identifies the aspirations of individual members of staff	+0.46
13	Knows when individual members of staff have realised their aspirations	+0.89

Sub-group: Facilitating in-servicing

33	Is involved in planning professional development for teachers	-0.58
34	Provides adequate resources for individual and collective professional development	-0.11

Sub-group: Intellectually stimulating staff

57	Applies professional experience when confronted with unusual or new situations	-0.60
56	Applies knowledge of past programs when confronted with unusual or new situations	-0.20
58	Questions prevailing knowledge and understanding of the school	+0.07
50	Generates debate about the future of the school	+0.28
48	Encourages particular members of staff to question specific aspects of school operations	+0.38
49	Stimulates staff-wide questioning of all aspects of the school's operations	+0.42
59	Provides unconventional insights into issues	+1.27

Group 5. Committing to mission realisation

Sub-group: Modeling commitment

24	Expresses the belief that this school can improve the lives of the students	-1.16
26	Is aware of aspects of the school programs requiring improvement	-0.06
68	Monitors student achievement throughout the school	-0.51
128	Is willing to address and resolve issues as they arise	-0.22
97	Questions the effectiveness of existing school programs and policies	-0.02
98	Discusses with teachers how the school could be re-organised	+0.33
130	Views potential problems as opportunities to improve the school	+0.56
129	Anticipates problems in advance	+0.72

Sub-group: Developing student and teacher commitment

67	Praises individual students	-0.91
18	Explains why teachers should work towards attaining the school's goals	-0.64
72	Acknowledges the work of individual teachers	-0.25
19	Commends teachers who enable attainment of the school's goals	-0.19

* The degree of teacher affirmation of the items is measured in logits (logarithmic units based on the logarithmic odds of answering positively).