

# **Pathways to health: The use of Product-term Regression Analyses to Examine Third Variable Influences using Examples of Burnout Research**

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*This paper attempts to differentiate between the various roles that a third variable can play in the adverse condition-wellbeing relationship (for example, stress-depression relationship). In addition, the appropriate statistical procedures for testing these roles are demonstrated using burnout research data. In this particular research project 207 secondary school teachers completed a range of research questionnaires designed to assess amongst others burnout, work environment, social support, personal competence, coping and problem-solving appraisal. Using this data the various roles that third variables can play, namely direct, moderating, mediating and indirect are demonstrated using product-term regression analyses.*

There is an abundance of research documenting an association between adverse conditions and physical as well as psychological functioning. For example, stress has been related to a broad range of health problems, including sudden cardiac death (Rahe & Lind, 1971), myocardial infraction (Rahe, Romo, Bennet, & Siltanen, 1974), pregnancy and birth complications (Gorsuch & Key, 1974) and chronic illness (Bedell, Giodani, Amour, Tavormina, & Boll, 1977). Psychiatric disorders that have been linked with stress include anorexia nervosa (Horesh, Apter, Lepkifker, Ratzoni, Weizman, & Tyano, 1995), anxiety (Faravelli, 1985) and schizophrenia (Leff, Kuipers, Berkowitz, Vaughn, & Sturgeon, 1983).

Similarly, within the work context the association between negative aspects of the work environment and physical and psychological strain has been well documented. For example, quantitative workload has been linked to anxiety (Broadbent, 1985), burnout (Pretorius, 1994a) and general psychological distress (Perrewe & Ganster, 1989). Other aspects of the work environment like role conflict and role ambiguity have also been found to be associated with burnout (Pretorius, 1994a) as well as job dissatisfaction and job-related anxiety (House & Rizzo, 1972; Rizzo, House, & Lirtzman, 1970).

However, even though the relationship between adverse environmental conditions and physical and psychological wellbeing has been well documented, from a research point of view the relationship was considered to be overly simplistic. For example, in stress research the magnitude of this relationship was generally very modest since obtained correlations typically ranged between 0.10 and 0.30 (Rabkin & Streuning, 1976), indicating that stress might account

for only about 9% of the variance in illness. Thus, from an earlier concern with documenting the effects of negative environmental conditions on physical and psychological functioning there has been a shift to identifying those variables that might influence this relationship. Examples of such variables include social support (Cohen, 1988; Cohen & Willis, 1985; Pretorius, 1994b, 1996; Pretorius & Diedricks, 1994), personal control (Johnson & Sarason, 1978), self-esteem (Kreger, 1995), willingness to use support resources (Pretorius, 1994b) appraisal of problem solving ability (Pretorius, 1992; Pretorius & Diedricks, 1994), organizational commitment and participation in decision-making (Pretorius, 1993a). These variables are conceptualized as making individuals differential vulnerable in the face of adverse environmental conditions.

These variables are often described as having a moderating function, i.e. moderating the harmful effects of negative environmental conditions. In South African research, (especially thesis work) this term (moderator) is often used interchangeably with mediator, despite the conceptual distinctiveness of the two (see Baron & Kenny, 1986, for a landmark paper on this distinction). In addition, incorrect inferences are very often drawn about the supposedly moderating (or mediating) effect of a third variable on the basis of zero-order correlations between the third variable and the independent (or health-outcome) variable or other inappropriate statistical analyses.

In reality, there are at least four different pathways through which a third variable can influence the relationship between a dependent (adverse environmental condition) and an independent variable (physical/psychological functioning), namely direct, moderating, mediating and indirect.

### **Direct Effects**

It has often been found that a variable that is presumed to play a role in protecting the individual from negative environmental conditions has a direct relationship with physical/psychological outcomes. For example, research has found that social support was directly related to depression (Lin, 1986; Pretorius, 1994b), that problem-solving appraisal was directly related to depression (Nezu, 1986; Pretorius, 1992) and anxiety (Nezu & Ronan, 1985), and that participation in decision-making and organizational commitment are directly related to burnout (Jackson, 1983; Pretorius, 1993a). This direct effects hypothesis is also referred to as the health-sustaining model (Shumaker & Brownell, 1984) which postulates that the effect of the third variable (for example, social support) on well-being are independent of the level of the negative environmental condition. In an extreme version, the direct effects hypothesis holds that an increase in the levels of the third variable will result in an increase in well-being, irrespective of the level of stress.

### **Moderating effect**

A moderator is described as a third variable that “affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable” (Baron & Kenny, 1986, p. 1174). In stress research moderator variables are said to have a stress-reducing function (Shumaker & Brownell, 1984) in the sense that it reduces the impact of stress on physical and psychological functioning. It is also referred to as the buffering hypothesis which postulates that these variables interact with stress in affecting psychological adjustment. For example, with regard to social support the buffering hypothesis would predict that at low levels of social support the relationship between stress and psychological well-being should be strong and direct (that is, high stress levels associated with low levels of psychological well-being), and as social support increases the relationship should weaken. Under conditions of maximal support the relationship between stress and well-being should be non-existent. Examples of such moderator variables in the literature have already been referred to above.

### **Mediating effects**

“Whereas moderator variables specify when certain effects will hold, mediators speak to how or why such effects occur” (Baron & Kenny, 1986, p. 1176). In general a third variable operates as a mediator when it transforms the predictor or input variable in some way. In this regard the third variable is the mechanism through which the adverse environmental condition influences the physical/psychological outcome. Baron and Kenny (1986) refer to perceived control as an example of a mediating construct. Essentially, if perceived control operates as a mediating variable it functions as the mechanism through which the adverse condition (independent variable) affects the physical/psychological outcome (dependent variable).

### **Indirect Effects**

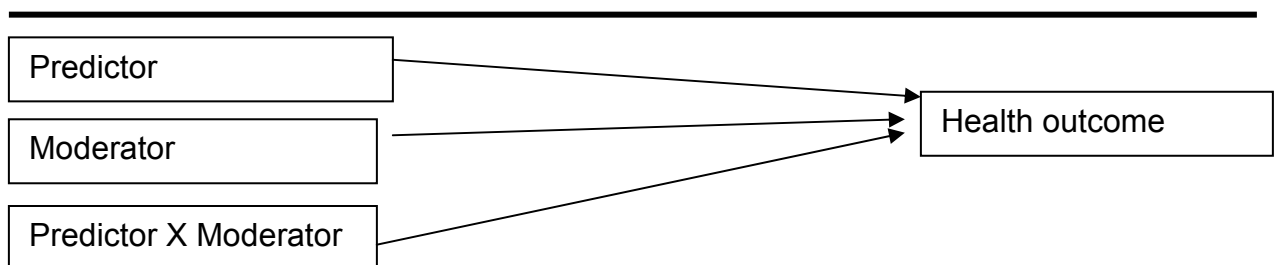
A third variable may not be directly related to physical/psychological functioning but may have an indirect effect by influencing perceptions of the environment/stressor. Moyle (1995) refers to this as a mediated pathway. In this regard the adverse condition is said to mediate the impact of the third variable on the dependent variable. In the stress literature this has mostly been studied in respect to personality dispositions. It is argued that people bring certain dispositions to for example the work setting and tend to interpret the setting in a manner that is consistent with this disposition which in turn results in certain outcomes. For example, Moyle (1995) found that the effect of negative affectivity on job satisfaction was mediated by perceptions of control in the workplace. Staw, Bell and Clausen (1986) found that the effect of positive affect on job satisfaction was mediated by job characteristics. More specifically, they

reported that people scoring high on positive affect perceived the characteristics of their jobs more positively and thus experience more job satisfaction. Levin and Stokes (1989) reports a similar finding and explains it by speculating that affectivity (Negative/Positive): “may influence how job-related information is translated and stored. As job related information is processed, it may be distorted to be consistent with one’s affective state” (p. 756).

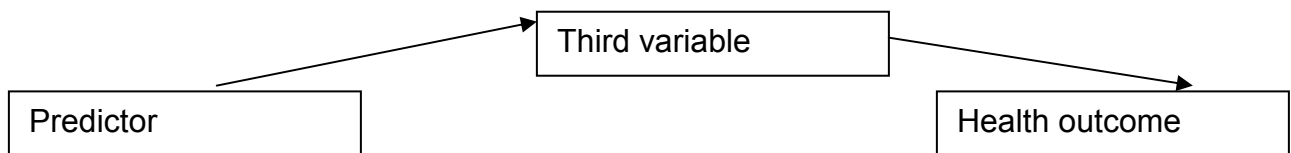
The difference between moderator, mediator, and indirect effects may be best understood by specifying causality between the various variables. This is done in Figure 1.

As can be seen in Figure 1 the moderator and adverse condition are at the same level with regard to their role as causal variables. In the case of mediator variables, however, the adverse conditions causally antecedent to the third variable, whilst in the case of indirect effects the third variable is causally antecedent to the adverse condition.

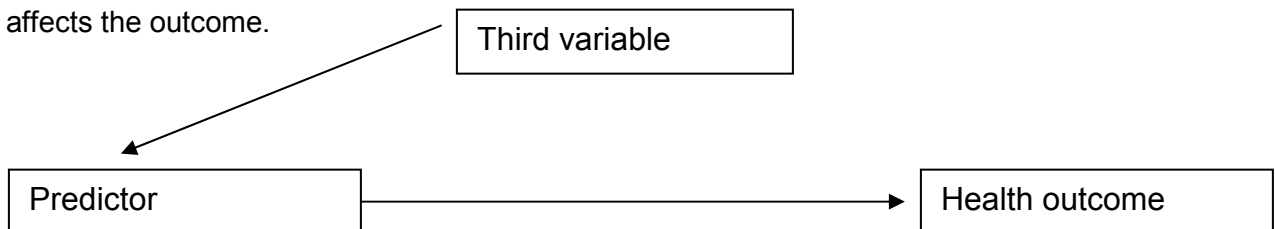
The aims of this paper are (1) to briefly report on a study of burnout amongst secondary school teachers, and (2) to use this data to demonstrate in a non-technical way the appropriate statistical analyses to examine the four roles of third variables outlined above.



1a: **Moderator effect** – the moderator interacts with the predictor in affecting health outcome.



1b: **Mediator effect:** The third variable acts as the mechanism through which the predictor affects the outcome.



1c: **Indirect effects:** The third variable leads to the interpretation of the predictor variable in a certain way which in turn affects the outcome variable.

**Figure 1: Illustration of moderator, mediator and indirect effects.**

## METHOD

### Subjects

The sample consisted of 207 secondary school teachers in the Western Cape. The teachers participated voluntarily and completed the measures at one sitting. The majority of the sample consisted of women (65.7%). The mean age of the sample was 33.03 ( $SD = 6.65$ ) and the mean number of years in teaching was 10.74 ( $SD = 7.42$ ). The language distribution of the sample was: English - 43.3%, Afrikaans - 46.8% and African language - 9.9%.

### Measures

Aspects of the work environment were assessed by means of the Occupational Roles Questionnaire (ORQ: Osipow & Spokane, 1987). This scale was designed to measure six different work roles, namely: (1) Role overload, which is the extent to which job demands exceeds the resources of the individual, (2) Role insufficiency, which is the extent to which skills are inappropriate to job requirements, (3) Role ambiguity, which is the extent to which priorities, expectations and evaluation criteria are clear, (4) Role boundaries, which is the extent to which the individual is experiencing conflicting role demands and loyalties, (5) Responsibility, which is the extent to which the individual feels responsible for others on the job, and (6) Physical environment, which is the extent to which the individual is exposed to high levels of environmental toxins or extreme physical conditions. The ORQ consists of 60 items (i.e. 10 per subscale) which are responded to on a 5-point scale ranging from "rarely or never" to "most of the time". Osipow and Spokane (1987) indicate reliability coefficients for the various subscales that ranged between 0.71 and 0.94. Comparable internal consistency coefficients were reported by Alexander, Monk and Jonas (1985) for a sample of military and civilian physicians. The existence of six independent subscales was also established through confirmatory factor analysis (Osipow & Spokane, 1987).

Psychological outcomes included burnout and anxiety. Burnout was assessed using the Maslach Burnout Inventory (MBI: Maslach & Jackson, 1986). The MBI provides a measure of three components of burnout, namely (1) Emotional Exhaustion, which is described as the tired and fatigued feelings that develop as emotional energies are drained and teachers are no longer able to give of themselves to students, (2) Depersonalization, which refers to indifferent and negative attitudes teachers display towards their students and is characterized by feelings of callousness and cynicism, and (3) Low Personal Accomplishment, which refers to the tendency to evaluate oneself negatively particularly with regard to one's work with students. The MBI consists of 22 statements scored on a 6-point scale. Persons with higher scores on

the Emotional Exhaustion and Depersonalisation scales and with lower scores on the Personal Accomplishment scale would be perceiving themselves as burned out. The reliability and validity of the MBI has been well documented. Coefficients of internal consistency typically ranged between 0.71 to 0.90 and test-retest reliability ranged between 0.54 to 0.80 depending on the test interval (Maslach & Jackson, 1986). Burnout as measured by the MBI has also been shown to be distinctly different from depression (Leiter & Durup, 1994) and from job satisfaction (Maslach & Jackson, 1986). The MBI has also been used in diverse samples, including Dutch, German and French samples (Schaufelli & van Dierendonck, 1995). In South Africa the MBI has been successfully used to assess burnout amongst church ministers (Odendaal & Van Wyk, 1988) and university teachers (Pretorius, 1994a).

Anxiety was assessed using the State-Trait Anxiety Inventory A-Trait Scale (STAI-T: Spielberger, Gorsuch & Luschene, 1970). The STAI-T provides a measure of generalized anxiety. It consists of 20 items to which subjects respond on a 4-point scale ranging from 1 (almost never) to 4 (almost always). High scores on the STAI-T indicate high levels of trait anxiety. Test-retest reliability ranged from 0.73 to 0.86 and the STAI-T demonstrated good internal consistency with alpha coefficients ranging from 0.83 to 0.92 (Maloney, Cheney, Spring, & Kanusky, 1986; Spielberger et al., 1970). Some studies also provided reliability and validity estimates for the STAI-T as used in Black South African samples (Pretorius, 1993b, 1998; Pretorius & Norman, 1992). In terms of concurrent validity, the STAI-T was significantly correlated with other anxiety and depression scales validated in South African samples (Pretorius, 1998; Pretorius & Norman, 1992).

Third variables that were presumed to influence the relationship between the work environment and psychological outcomes included personal competence and problem-solving appraisal.

Personal competence refers to the feeling of mastery over oneself and one's environment. The Personal Competence Scale was developed by Campbell, Converse, Miller, and Stokes (1960) and it has been applied in various political surveys (Robinson, Rusk & Head, 1968). It consists of eight items scored on a four-point scale ranging from (1) strongly agree to (4) strongly disagree. The responses to all the items are totalled to produce a measure of the degree of personal competence. A high score indicates a high sense of personal competence. Dean (1986) reported acceptable, although not strong, alpha coefficients for the scale (0.56 to 0.64) as well as item-total correlations ranging from 0.35 to 0.58. In terms of validity, it was found that the scale demonstrated consistent and strong relationships to depression, with correlations ranging from -0.31 to -0.41. It was therefore concluded that the scale possesses

sufficient strengths in terms of reliability and validity. The reliability of the Personal Competence scale as used with a South African sample has been reported by Pretorius (1993b, 1997).

Appraisal of problem-solving ability was measured with the Problem Solving Inventory (PSI: Heppner & Petersen, 1982). The PSI was developed to assess perceptions of one's problem-solving capabilities rather than actual problem-solving capabilities. It reflects the evaluative awareness of one's problem-solving skills, that is, it provides a global appraisal of oneself as a problem solver. The PSI consists of 32 items rated on a six-point scale where low scores are indicative of perceptions of effective problem-solving ability. There are three factors on the PSI: problem-solving confidence (belief and trust in one's problem-solving abilities), approach-avoidance style (general tendency to approach or avoid different problem-solving activities) and personal control (the belief that one is in control of one's emotions and behaviours while solving problems). In addition a total PSI score is used as a single general index of problem-solving appraisal. Only this total PSI score is used in the current project. The Problem Solving Inventory appears to be a highly reliable instrument with coefficients of internal consistency ranging between 0.72 and 0.92 and coefficients of stability between 0.83 and 0.89. In terms of validity the Problem Solving Inventory appears to measure constructs that are amenable to change through problem solving training and that are related to self-perceptions of problem solving skills (Heppner, 1988). The Problem Solving Inventory has also been found to be significantly correlated with behavioral observations of actual competence in solving problems (Heppner, Hibel, Neal, Weinstein, & Rabinowitz, 1982). It has also been found to be a reliable and valid measure for use with black South African students (Pretorius, 1993b).

### **Statistical Analyses**

The four roles of third variables can be examined using two sets of regression analyses. In the first regression analysis the physical/psychological outcome is used as the dependent variable. The adverse condition is then entered in the first step, the adverse condition and third variable together are entered in the second step and the product of the adverse condition and third variable (adverse condition X third variable) are entered in the third step. The second regression analysis only differs from the first in terms of step one. Here the third variable is entered as step one instead of the adverse condition. To avoid the problem of multicollinearity and to assist with the interpretation of interaction effects the deviation scores (score minus mean) of the adverse condition and the third variable should be used in the calculation of the product term (Baron & Kenny, 1986; Cohen & Cohen, 1975; Dunlap & Kemery, 1987; Finney, Mitchell, Cronkite, & Moos, 1984).

A significant effect for the third variable in step one of the alternative regression analysis indicates a direct effect of the third variable on the outcome. This implies that the third variable influences the outcome directly, irrespective of the level of the adverse condition. This would be consistent with the health-sustaining hypothesis.

The second step of the regression analyses indicates whether the third variable has a mediating or indirect effect. If in step one the adverse condition is found to predict the outcome, but in step two is reduced to an insignificant level this would indicate that the third variable operates as a mediator variable. If, however, it is the third variable that is reduced to an insignificant level in step two the adverse condition is said to be the mediated pathway, i.e. the third variable has an indirect effect on the outcome variable.

The third step of the regression analysis indicates whether the third variable acts as a moderator. If the product of the third variable and the adverse condition is significant in the third step this is indicative of a moderating effect. The exact nature of such moderating effects are usually examined by comparing those high on the moderator variable with those low on the moderator variable in terms of the relationship between the adverse condition and the physical/psychological outcome.

The above analyses are summarized in Table 1.

**Table 1**  
**Summary of different steps in Product term regression analyses**

Step	Predictor	Result	Conclusion
1	Adverse condition	Significant	Adverse condition has direct effect on outcome
1 (in second regression)	Third variable	Significant	Third variable has direct effect on outcome
2	Adverse Condition	Significant	If third variable significant in previous step, but not significant in step 2 then an indirect effect.
	Third variable	Non-signif.	
2	Adverse condition	Non-signif.	If adverse condition significant in previous step but not significant in step 2, then a mediating effect.
	Intervening variable	Significant	
3	Product intervening & Adverse condition	Significant	Moderating effect

## RESULTS

The means, standard deviations and reliability coefficients (alpha) for the various scales are reported in Table 2.

**Table 2**  
**Means, Standard deviations and reliability coefficients of scales**

Scale	Mean	SD	Alpha
<u>ORQ (occupational roles)</u>			
Role Overload	29.21	7.42	0.77
Role Insufficiency	26.01	7.17	0.79
Role Ambiguity	23.04	6.68	0.72
Role Boundaries	23.76	6.28	0.66
Responsibility	26.12	7.18	0.72
Physical Environment	20.30	7.48	0.84
<u>MBI (Burnout)</u>			
Emotional Exhaustion	23.57	12.72	0.90
Depersonalisation	7.48	5.98	0.70
Accomplishment	33.62	7.57	0.73
STAI-T (anxiety)	42.00	10.39	0.90
Personal Competence Scale	23.04	3.09	0.55
PSI (Problem solving appraisal)	84.20	19.56	0.85

The reliability of the various scales appears satisfactory with the exception of the Personal Competence Scale. It is, however, comparable to previously reported reliabilities for this scale (Dean, 1986; Pretorius, 1997) as well as other similar competence scales (Husaini, Neff, Newbrough, & Moore, 1981).

The intercorrelations between those variables that will be used to demonstrate the various models (moderator, mediator, indirect and direct) are shown in Table 3.

**Table 3**  
**Intercorrelations between variables**

	2	3	4	5	6	7
1. Ambiguity	.27**	.38**	-.17*	.40**	-.29**	.36**
2. Overload	1.00	.44**	.034	.26**	-.02	.13
3. Emotional exhaustion		1.00	-.19*	.59**	-.26**	.29**
4. Accomplishment			1.00	-.39**	.26**	-.43**
5. Anxiety				1.00	-.51**	.52**
6. Competence					1.00	-.48**
7. PSI						1.00

\*\*p 0.01

\*p. 0.05

The work environment measures (overload and ambiguity) are significantly related to the health outcome measures (anxiety, emotional exhaustion and personal accomplishment), with the exception of the relationship between overload and personal accomplishment, which was not significant. Role ambiguity was also significantly related to those variables that are presumed to play a role between adverse condition and health outcome (competence and problem-solving appraisal). Lastly, the health outcomes were all significantly related to these third variables.

To demonstrate the various roles that third variables can play in the adverse condition-health outcome relationship, three different 'case studies' were selected, namely, (1) the role of personal competence in the relationship between role ambiguity and emotional exhaustion, (2) the role of personal competence in the relationship between role ambiguity and personal accomplishment, and (3) the role of problem solving appraisal in the relationship between role overload and anxiety.

### **1. The role of personal competence in the relationship between role ambiguity and personal accomplishment**

To examine the role of personal competence in the relationship between role ambiguity and personal accomplishment, two separate product-term regression analyses were done. In

the first regression analysis personal accomplishment was used as outcome variable, role ambiguity was entered as step one, role ambiguity and personal competence were entered together in step two and the product of role ambiguity and personal competence were entered in step three. The second regression analysis only differed from the first in terms of step one. Instead of role ambiguity, personal competence was entered in step one of the second regression analysis. The results of these analyses are shown in Table 4.

**Table 4**  
**Product-term regression analyses using personal accomplishment as outcome and role ambiguity and personal competence as predictors**

Predictor <sup>a</sup>	df	Cum. R <sup>2</sup>	t-value Beta	
Ambiguity	1,162	0.03	-2.40	-0.19*
Competence <sup>b</sup>	1,162	0.07	3.35	0.25**
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Ambiguity	1,161		-1.63	-0.13
Competence	1,161	0.08	2.82	0.22**
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Ambiguity X Competence	1,160	0.08	-0.19	-0.02

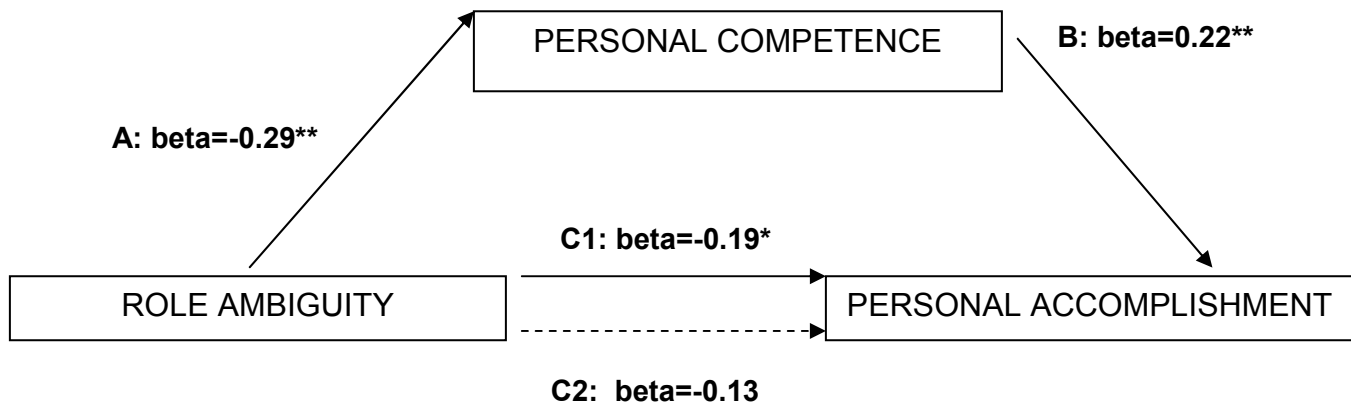
<sup>a</sup> a dashed line represents different steps in the regression analysis

<sup>b</sup> alternative first step in a separate regression analysis

\*\*p 0.01

\*p. 0.05

The product-term of personal competence and role ambiguity is non-significant, indicating no interaction/moderating effects. Whereas the relationship between ambiguity and personal accomplishment is significant in step one, it becomes statistically non-significant in step two when ambiguity is entered simultaneously with personal competence. This is indicative of a mediating effect for personal competence, i.e. that the effect of role ambiguity on personal accomplishment is mediated by personal competence. This is illustrated in Figure 2.



\*\*p 0.01

\*p. 0.05

**Figure 2: Personal competence mediating the effect of role ambiguity on accomplishment**

Figure 2 illustrates the various conditions Baron and Kenny (1986) view as necessary to demonstrate a mediating effect for the third variable. Firstly, the independent variable must affect the mediator. This is shown in path A (established through an additional regression analysis) where there is a significant association between role ambiguity and personal competence. Secondly, the mediator must affect the dependent variable. This is shown in path B (step one of the second regression analysis) where there is a significant association between personal competence and personal accomplishment. Thirdly, the independent variable must affect the dependent variable. This is shown in path C1 (step one of the regression analysis) where there is a significant association between role ambiguity and personal accomplishment. Lastly when the mediator is controlled for (by entering it simultaneously with the independent variable into the regression equation – step two) the effect of the independent variable on the dependent variable should be reduced. When personal competence was controlled for the relationship between role ambiguity and personal accomplishment became non-significant. This is indicated by path C2 where the dashed line indicates a non-significant association.

## **2. The role of personal competence in the relationship between role ambiguity and emotional exhaustion**

As before, two separate product-term regression analyses were done. In the first

regression analysis emotional exhaustion was used as outcome variable, role ambiguity was entered as step one, role ambiguity and personal competence were entered together in step two and the product of role ambiguity and personal competence were entered in step three. In the second regression analysis personal competence was entered in step one. The results of these analyses are shown in Table 5.

**Table 5**  
**Product-term regression analyses using emotional exhaustion as outcome and role ambiguity and personal competence as predictors**

Predictor <sup>a</sup>	df	Cum. R <sup>2</sup>	t-value	Beta
Ambiguity	1,166	0.16	5.56	0.40**
Competence <sup>b</sup>	1,166	0.06	-3.21	0.24**
-----				
Ambiguity	1,165		4.85	0.36**
Competence	1,165	0.18	-1.94	-0.14
-----				
Ambiguity X Competence	1,164	0.18	-0.19	-0.02

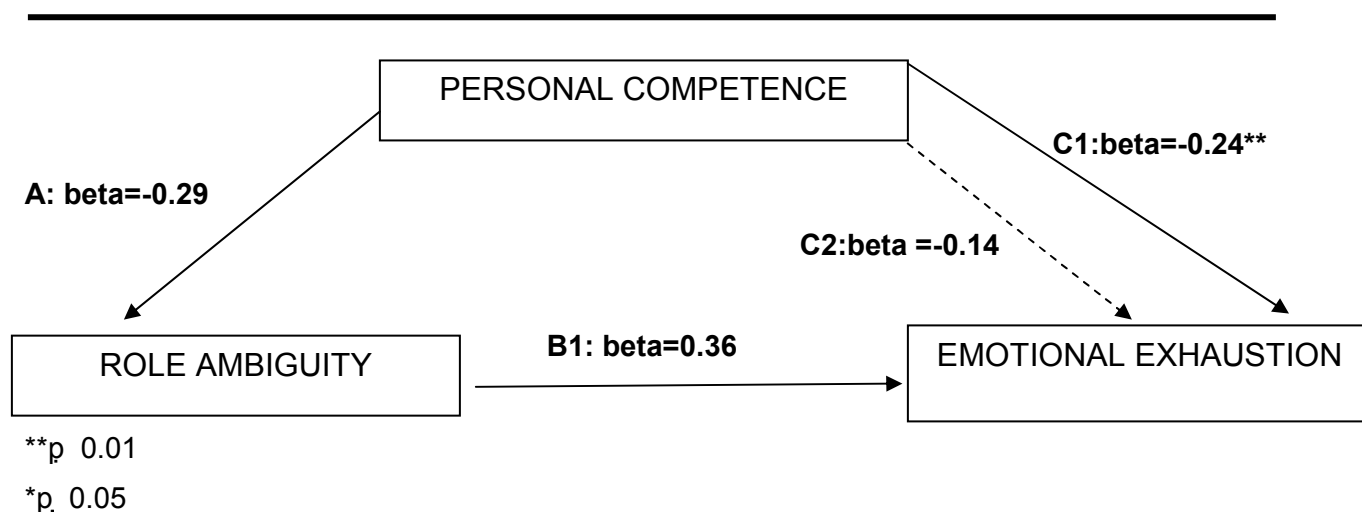
<sup>a</sup> a dashed line represents different steps in the regression analysis

<sup>b</sup> alternative first step in a separate regression analysis

\*\*p. 0.01

\*p. 0.05

There are no significant moderating effects as indicated by the fact that the product-term is not significant. In the first step personal competence is a significant predictor of emotional exhaustion, but is not significant in step two when entered together with role ambiguity. This would indicate an indirect effect for competence on emotional exhaustion, i.e. that the effect of competence on emotional exhaustion is indirect through perceptions of the work environment (role ambiguity). This is illustrated in Figure 3.



**Figure 3: Indirect effects of personal competence – personal competence affects emotional exhaustion indirectly through perceptions of the work environment**

Figure 3 shows that the relationship between competence and emotional exhaustion is significant when competence is considered on its own (path C1). However, when competence and ambiguity were considered together (step two of the regression analysis) the relationship between competence and emotional exhaustion became non-significant as indicated by path C2.

### **3. The role of problem-solving appraisal in the relationship between role overload and anxiety**

Role overload was entered into the first step of the regression analysis, role overload and problem-solving appraisal together in the second step and the product of role overload and problem-solving appraisal in the third step. In the separate regression analysis problem-solving appraisal was entered into the first step. The results of these analyses are reported in Table 6.

**Table 6**  
**Product-term regression analyses using anxiety as outcome and role overload and problem-solving appraisal as predictors**

Predictor <sup>a</sup>	df	Cum. R <sup>2</sup>	t-value	Beta
Overload	1,134	0.08	3.38	0.28**
Problem-solving appraisal <sup>b</sup>	1,134	0.27	6.94	0.51**
-----				
Overload	1,133		2.86	0.21**
Problem-solving appraisal	1,133	0.31	6.63	0.48**
-----				
Overload X Problem-solving Appraisal	1,133	0.33	2.22	0.16*

<sup>a</sup> a dashed line represents different steps in the regression analysis

<sup>b</sup> alternative first step in a separate regression analysis

\*\*p 0.01

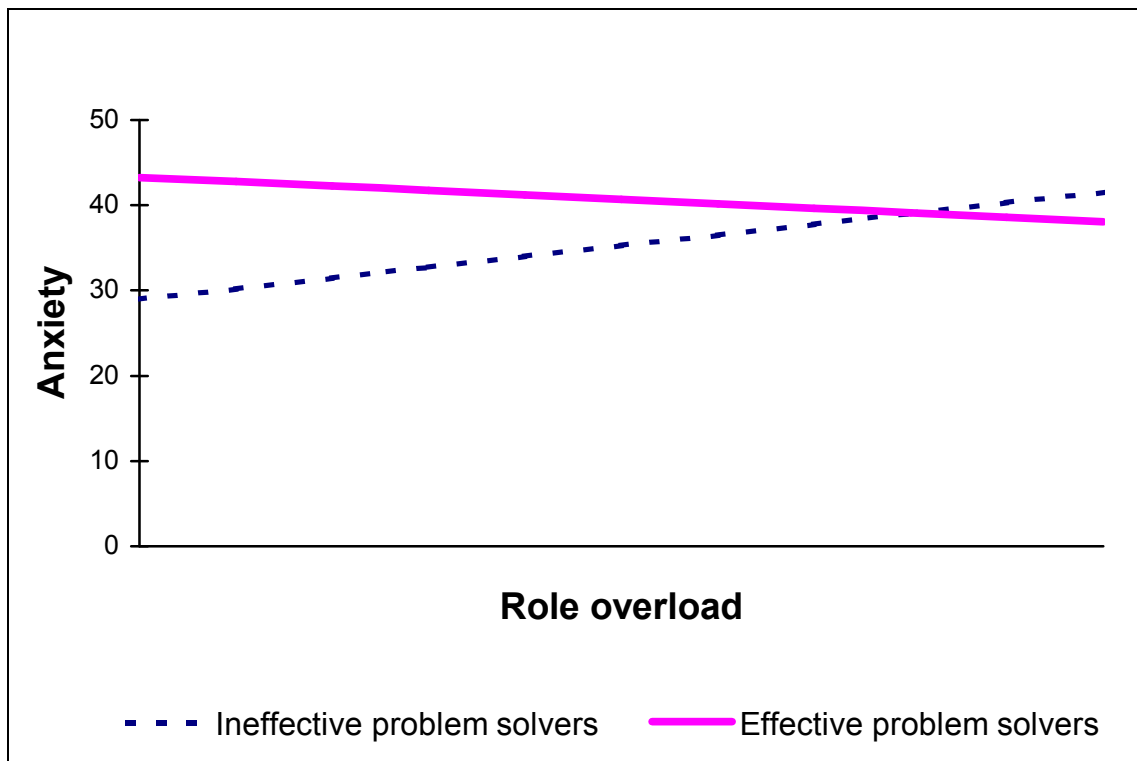
\*p. 0.05

In the first step (of the alternate regression analysis) problem-solving appraisal was significantly associated with anxiety. This points to the direct effects of problem-solving appraisal on anxiety. This finding is further confirmed by the fact that neither problem-solving appraisal nor role overload was significantly reduced in step two of the analysis. Thus no mediating or indirect effects are present. However, the product-term of problem-solving appraisal and role overload is significant. This points to a moderating effect for problem-solving appraisal. Cohen and Cohen (1975) suggests that the nature of the interaction/moderating effect can be established by comparing the regression lines of those high on the moderator variable with those low on the moderator variable.

Following the procedure suggested by Cohen and Cohen (1975), two different regression lines were calculated - one for those high in problem-solving appraisal (ineffective problem solvers - at or above the 75<sup>th</sup> percentile, N=44) and one for those low in problem-solving appraisal (effective problem solvers - at or below the 25<sup>th</sup> percentile, N=40). The graph for high and low problem-solving appraisal for the relationship between role overload and anxiety are shown in Figure 4.

The regression line for those defined as ineffective problem solvers (high scores on PSI) was much steeper (slope = 0.63) than that of the effective problem solvers (low scores on PSI).

In fact the regression line for the effective problem solvers shows a slight decline (slope = -0.26). There was also a significant positive relationship between role overload and anxiety for the ineffective problem solvers ( $r = 0.38$ ,  $p < 0.01$ ), while this relationship was negative (not significant) for the effective problem solvers ( $r = -0.18$ ). This indicates that an increase in role overload is significantly associated with an increase in anxiety but only for those who perceive themselves as ineffective problem solvers. For effective problem solvers the relationship between role overload and anxiety actually weakens.



**Figure 4: The regression of Anxiety on Role Overload for high and low problem solving appraisal**

## DISCUSSION

The purpose of this paper was to demonstrate the potential direct, mediating, moderating and indirect effects that a third variable might play in the adverse condition-health outcome relationship and to provide an overview of the appropriate statistical analyses for determining these effects. This was done by using burnout research conducted amongst secondary school teachers. Using this data the direct and moderating effects of problem-

solving appraisal on the role overload-anxiety relationship, the mediating effects of personal competence in terms of the role ambiguity-personal accomplishment relationship, and the indirect effects of personal competence on the role ambiguity-emotional exhaustion relationship were illustrated.

A word of caution: In cross-sectional studies of this nature certain assumptions about causal paths have to be made. These assumptions are made on theoretical rather than strict empirical grounds. For example, role overload are presumed to be causally antecedent to anxiety. However, it could well be that an overanxious individual tends to experience the work environment negatively in terms of role overload. These cross-sectional designs are however important in identifying potential causal paths that can be pursued through more sophisticated longitudinal designs and by using a triangulation of data sources.

The findings with regard to the three examples used not only make theoretical sense but are also consistent with previously reported studies. The results pertaining to the direct and buffering roles of problem-solving appraisal supports those of previous studies (Nezu, 1986; Nezu & Ronan, 1985; Pretorius, 1992). This indicates, firstly, a health-sustaining role for problem-solving appraisal in the sense that, irrespective of whether the individual is confronted with an adverse environmental condition, perceiving yourself as an effective problem solver is beneficial for health. Secondly, it indicates a stress-buffering role for problem-solving appraisal. In this regard, it was found that at high levels of problem-solving appraisal (ineffective problem solver) the relationship between role overload and anxiety is very strong. As problem-solving appraisal decreases (towards more effective problem solving) the relationship between role overload and anxiety weakens. In other words, if a self-perceived effective problem solver and a self-perceived ineffective problem solver were exposed to the same level of role overload, the self-perceived ineffective problem solver would experience higher levels of anxiety.

It was also found that personal competence mediates the relationship between role ambiguity and personal accomplishment. To the extent that personal competence reflects the feeling of control over oneself and one's environment this finding would link very well to social psychological research which have long accepted the control mediational model of density-crowding (Baron & Kenny, 1986; Baron & Rodin, 1978). A mediational role for personal competence implies that role ambiguity is not directly related to burnout (personal accomplishment) but that personal competence is the mechanism through which ambiguity impacts on burnout. In other words, a work environment characterised by high levels of role ambiguity would indirectly lead to high levels of burnout, depending on the level of personal competence of the individual. In this model ambiguity is causally antecedent to personal

competence. In terms of Baron and Kenny's (1986, p. 178)) explanation personal competence represents "properties of the person that transforms the..." work environment (role ambiguity) in some way.

Personal competence also demonstrated an indirect effect on emotional exhaustion by influencing perceptions of the work environment (role ambiguity). In this model personal competence is causally antecedent to role ambiguity, whereas in the mediational model it was the other way around. In other words, there is no direct relationship between personal competence and burnout (emotional exhaustion), but personal competence colours the perception of the work environment, which results in burnout. Thus, one can hypothesize that those high in personal competence are more likely to perceive the work environment as manageable (low in ambiguity) resulting in lower levels of burnout. On the other hand, those low in personal competence are more likely to perceive the work environment as unmanageable (high in ambiguity) leading to higher levels of burnout. This is consistent with the argument put forward in the introduction to this paper, namely that people bring certain dispositions to the work setting and tend to interpret the work environment in manner that is consistent with that disposition.

In order to understand all the possible mechanisms through which third variables can sustain health and/or reduce the negative effect of adverse conditions it is important that we examine all the possible pathways mentioned in this paper. Failure to do that would not only limit the contribution to science in general that research of this nature can make, but also impact on our ability to develop appropriate interventions. It is, however, essential that these pathways be examined with appropriate statistical techniques. Although sophisticated researchers might prefer the use of structural modeling, this paper attempted to demonstrate, in a very non-technical way, an equally acceptable procedure that would possibly be more accessible to the general researcher/student.

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