

Ulla Kinnunen  
Teacher stress  
over a school year

UNIVERSITY OF JYVÄSKYLÄ

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## ABSTRACT

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The main aims of the study were (1) to study how teacher stress proceeds as an accumulation/recovery process over one school year and how good a possibility the profession offers for annual recovery from stress; (2) to explore interindividual differences in stress and coping process among teachers; and (3) to study the relationships between teacher stress and urinary excretion of catecholamines during night rest.

The subjects of the study were teachers (N=187) of comprehensive and upper secondary schools in five municipalities. The study design was longitudinal: questionnaire data and urine samples were collected from the subjects 17 times during a period of 14 months, from April 1983 to May 1984. The measurements represented both weekends or holidays and workdays. The background variables were based on personnel records data and on a questionnaire the subjects answered in the autumn of 1983.

The results indicated that teacher stress had an identifiable cycle within the school year. The possibility for annual recovery from stress was good during the spring term, whereas towards the end of the autumn term recovery stopped and stress accumulated. The effect of Christmas holidays was noticed as it upset the stress accumulation process to some extent. When exploring the stress process over the autumn term more accurately four types of stress processes and three types of coping profiles were found. This means that there were large interindividual differences in stress and coping among the teachers. It seemed that catecholamine excretion during night rest, and especially adrenaline excretion, worked as an index of stress when the subjective stress level was high among the teachers, i.e. at the end of the term or in a group with high stress.

Keywords: teacher, stress, coping, catecholamines, night rest, school year, comprehensive school, upper secondary school.

## LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following publications, which are referred to in the text by their Roman numerals.

- I Mäkinen, R. & Kinnunen, U. (1986) Teacher stress over a school year. *Scandinavian Journal of Educational Research*, 30, 55–70.
- II Kinnunen, U. (1988) Origins of teacher stress at different points of the autumn term. *Scandinavian Journal of Educational Research*, 32, 153–162.
- III Kinnunen, U. & Leskinen, E. (1989) Teacher stress during a school year: Covariance and mean structure analyses. *Journal of Occupational Psychology*, 62 (in press).
- IV Kinnunen, U. (1988) Teacher stress during an autumn term in Finland: four types of stress processes. *Work and Stress*, 2, 333–340.
- V Kinnunen, U. (1987) Teacher stress over an autumn term: relationships between subjective stress and catecholamine excretion during night rest. *Scandinavian Journal of Psychology*, 28, 293–303.

## PREFACE

The study presented here has been carried out since 1983 when the project to explore teacher stress over a school year began at the Department of Psychology, University of Jyväskylä. The origins of this study date back to a joint research project on the working conditions and well-being of teachers in the Nordic countries in the late seventies.

I express my warmest gratitude to Dr. Raimo Mäkinen (from the Institute for Educational Research, University of Jyväskylä), head of the present project, for his encouragement during the study. I am also grateful to Dr. Veikko Vihko (from the Foundation for the Promotion of Physical Culture and Health) who has acquainted me with the biological analyses of stress hormones. All the hormonal analyses of this study were done under his supervision at the Department of Biology, University of Jyväskylä.

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I wish to also thank Leena Kaihlajärvi, the laboratory assistant, who has done all the biological analyses of this study with experience. Ari Mäkiäho, B.S., has helped me with the statistical LISREL analyses and Auli Batts, B.A., has done a lot to correct my insufficient English. The language of the final manuscript was checked by Alison Lorys-Vernon, Ph.D.

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Finally, I thank my husband Juha and my dachshund Aatu, my dear boys, who have helped me in many ways; a good way to cope with stress for me is to take a walk with them — that has calmed me many times.

Jyväskylä, May 1989

Ulla Kinnunen

# CONTENTS

<b>1 INTRODUCTION</b> .....	1
<b>2 THEORETICAL FRAMEWORK OF THE STUDY</b> .....	3
2.1 Concepts of stress .....	3
2.2 General characteristics of stress models .....	4
2.3 Methodological problems of stress research .....	6
2.4 Catecholamines and stress .....	7
2.5 Occupational stress — teacher stress as an example .....	9
2.5.1 Traditional research themes of teacher stress .....	11
2.5.2 New research themes of teacher stress .....	13
2.6 A brief summary of the framework .....	16
<b>3 PURPOSE OF THE STUDY</b> .....	17
<b>4 MATERIAL AND METHODS</b> .....	19
4.1 Subjects .....	19
4.2 Methods of data collection .....	21
4.3 Statistical methods .....	26
<b>5 RESULTS</b> .....	27
5.1 Teacher stress over a school year (I, II, III) .....	27
5.2 Interindividual differences in stress and coping: stress process and coping profiles (IV) .....	30
5.3 Catecholamine excretion during night rest as a measure of accumulated stress (V) .....	32
<b>6 DISCUSSION AND CONCLUSIONS</b> .....	37
6.1 Main findings .....	37
6.2 Methodological evaluation .....	40
6.3 Solutions for the prevention of teacher stress on the basis of this study .....	42
<b>TIIVISTELMÄ: OPETTAJAN TYÖSTRESSI LUKU- VUODEN AIKANA</b> .....	45
<b>REFERENCES</b> .....	48
<b>APPENDIX I</b> .....	59

## 1 INTRODUCTION

A great deal of research has been carried out on the teacher stress problem in many countries, for instance in the USA (e.g. Coates & Thoresen, 1976; Phillips & Lee, 1980; Blase, 1986; Fimian, 1987), in the UK (e.g. Dunham, 1976, 1984; Kyriacou & Sutcliffe, 1977, 1978, 1979; Kyriacou, 1980a), in Norway (e.g. Vestre, 1976; Mykletun, 1984, 1985), in Sweden (e.g. Wahlund & Nerell, 1976; Lundberg, 1981; Tellenback, Brenner & Löfgren, 1983) and also in Finland (e.g. Ruohotie, 1980; Aho, 1981; Mäkinen, 1982; Ojanen, 1982; Stjernberg, 1986). In all these cross-sectional studies the main questions explored have been of the type: (a) How stressed are teachers?; (b) What are the perceived sources of stress?; and (c) What are the correlates of teacher stress?

Despite the great number of studies little has been done to trace the dynamics of teacher stress over a period of time, i.e. themes concerning stress as a process which proceeds in time and usually ends — because of successful recovery and coping — without any abnormal end states, have not been in the focus of teacher stress studies. Hembling and Gilliland (1981) in the USA and Ojanen (1982) in Finland touched upon these issues when they discussed the possibility of teacher stress having an identifiable cycle within the school year. Neither of these studies, however, actually assessed the stress of teachers at different points of the school year. Not until recently have longitudinal studies on teacher stress increased (Brenner, Sörbom & Wallius, 1985; DePaepe, French & Lavay, 1985; Fleischut, 1985; Rajala, 1988).

In this present study the approach mentioned above was utilized. The general aim was to monitor the psychological and somatic well-being of teachers over one school year in order to study the accumulation of and the recovery from stress as well as factors which contribute to both of these. The idea of studying the accumulation of stress and the recovery from it led to an examination of the work-and-rest cycle in the teaching profession. Actually, very little is known about how teacher stress accumulates and how one recovers from it during one school day and subsequent night time rest, during one school week and weekend, or during terms and holidays.

The methodological approach applied carried forward recent developments in stress research. In all, when compared to previous teacher stress research, three new themes were adapted in this study. First, the study design was longitudinal and intensive (17 measurements altogether) by its nature; second, a multi-method approach to measurement was utilized; and third, the idea of coping and recovery was applied and brought into practice by emphasizing stress prevention mechanisms. The aim of this comprehensive approach to stress research was to obtain a better understanding of teacher stress.

The present study design originated in the finding of a cross-sectional study that in the teaching profession some signs of relatively high acute stress were combined with a low rate of severe health problems (Mäkinen, 1982). The hypothesis was that this combination might be partly explained by the good possibilities for annual recovery from stress in the profession. Cross-sectional studies do not, however, reveal whether this hypothesis is true. The hypothesis must be tested by longitudinal studies covering the whole school year so that the patterns of accumulation of and recovery from stress can be analysed.

In order to avoid the shortcomings of subjective self-reports (i.e. a problem of single-method research) some objective stress indicators were used. The sympathetic-adrenal medullary system with its secretion of catecholamines was brought into focus. The catecholamines, adrenaline and noradrenaline, have generally been shown to be sensitive indicators of psychological stress. However, in this study the focus was on catecholamine excretion during night sleep, which needs further exploration for its usefulness as an index of "unwinding" and sustained work stress.

The perceived combination of high acute stress and low rate of severe health problems does not mean that stress does not contribute to severe health impairments among teachers. However, it must be remembered also that many other factors besides differences in the psychosocial stressfulness of work may lead to occupational differences in the general state of health. Physical-chemical work hazards and work accidents which are very rare in the profession under study can be mentioned as examples of these other factors. Research on stress at work has become an overall perspective which includes most of the more specific attempts to analyse different effects of work on well-being.

Within occupational stress research, the emphasis is being moved to coping which has become a central variable in psychological stress research and is increasingly implicated as an important factor reducing stress and contributing to the recovery from stress. In general, emphasizing coping in stress research means that the focus is on what keeps people healthy and on factors that might protect a person from the effects of stress.

## 2 THEORETICAL FRAMEWORK OF THE STUDY

### 2.1 Concepts of stress

Not everyone concerned with stress-related issues is convinced of the value of the concept of stress. It has been claimed (e.g. Mason, 1971; Hinkle, 1974; Ursin, 1982) that the stress concept was valuable in the past but is no longer necessary, because the phenomena included under stress can be described and sufficiently understood without the stress concept. 'Stress' encompasses a large variety of phenomena and that is why it is seen as useful mainly as a rubric of a wide field of research (Lazarus, 1966; Lazarus & Folkman, 1984). Engel (1985, p. 10) goes one step further by concluding that "... stress is neither a noun, nor a verb, nor an adjective. It is an escape from reality".

Some stress concepts grow out of biology and physiology emphasizing the biological mechanisms of the organism, some are derived from psychology, and still others have their origin in social sciences. In addition, researchers have treated stress as an independent, a dependent or an intervening variable. Stress definitions can be placed into one of three groups representing the main approaches to stress: stress is defined in terms of stimulus parameters, response parameters or stimulus-response interactions (e.g. McGrath, 1970; Mason, 1975; Laux & Vossel, 1982; Cox, 1983; Kasl, 1983).

Stimulus definitions focus on events in the environment with harmful effects on the individual. Within the stimulus category two fundamentally different usages are found; namely, stress is defined either as an environmental condition or an appraisal of an environmental situation. Response definitions refer to a state of stress; stress is described by response parameters to different disturbing environmental factors. Stimulus and response definitions have limited utility because a stimulus is defined as stressful only in terms of a stress response and a response in terms of a stressor.

The current stress theory treats stress mainly in terms of an interaction

variable emphasizing the relationship between the individual and his environment. It is suggested that stress occurs when the environment imposes demands which are perceived as being substantially out of balance with the person's ability to meet the demands. In addition to the person's capabilities, also the person's expectations are important; stress refers to the imbalance between what the person expects or demands to get from the environment and what the person actually gets. These interaction definitions of stress take into account the characteristics of the person on one hand, and the nature of the environmental event on the other.

Research on stress falls, in general, into one of two broad categories (cf. Fried, Rowland & Ferris, 1984; Singer & Davidson, 1986). The first of these categories is essentially physiologically defined. It is the original notion of stress formulated by Selye (1956). Stress is a response to environmental stimuli which can directly impact the person's responses, i.e. the organism is reactive and little cognition is involved in the model. Research done within this category measures physiological and endocrinological changes as indications of stress. The second category, in contradistinction, is psychologically defined and transactional. The general approach taken by Lazarus (1966) is an example of this type of work.

Lazarus (1976; Lazarus & Folkman, 1984) has suggested that stress occurs when there are demands placed on the individual which "tax or exceed his coping resources". Particular attention is paid to the person's cognitive appraisal of the situation and his ability to cope, which determines why and to what extent a particular transaction between the person and the environment is stressful. The focus of transaction can be situated at any system level: social, psychological or physiological. The process of cognitive appraisal (e.g. Cox, 1987) means that there may be significant individual differences in stress experienced in any given situation and under any given level of demand because of the differences in the ability to cope. In addition, stress may arise from both underload (demands < resources) and overload situations (demands > resources).

## 2.2 General characteristics of stress models

Stress research is one of the areas of health research. It is said (e.g. Kronholm, 1983) that stress research has developed two important theoretical ways of thinking in this regard: (1) the activation theory, which explains how stress — mental strain — can lead to illness; and (2) the coping theory which clarifies how one can avoid getting ill. It seems that emphasis has recently been put on the coping theory which means, in a simplified form, that stress does not expose an individual to illness but rather the way of coping with stress does.

In spite of the differences in the definition of the stress concept, there are many similarities in the characterizations of the stress models. For instance, the process of stress is often seen as combining three major conceptual domains: sources of stress, mediators of stress, and manifestations of stress (e.g. work stress models of Cooper & Marshall, 1976; Cherniss, 1980; House et al., 1986; and general life stress models of Kagan & Levi, 1974; Jenkins, 1979; Lazarus et al., 1985; Cottington & House, 1987). In most of the models three basic types of manifestations are separated; namely, the psychological (e.g. emotional, motivational, cognitive), behavioral (e.g. absenteeism, insomnia, alcohol consumption), and physiological (e.g. excretion of catecholamines, cortisol, aldosterone, prolactin, growth hormone) reactions. Depending on the level of differentiation of the chronologically successive phases in the process, health outcomes are added onto the models.

The sources of stress are often seen as arising out of two broad circumstances: the occurrence of discrete events and the presence of continuous problems. This means that the nature of stress is seen either as episodic or chronic with varying severity of outcomes. Other kinds of taxonomies of potential stressors have also been proposed (cf. Lazarus & Cohen, 1977; Elliot & Eisdorfer, 1982). In current theory — although certain situations (e.g. natural disasters) are considered normatively stressful — the actual stressors are seen to be determined by cognitive processes which intervene between the stressors and the reactions. In addition, the emphasis put on possible intervening variables varies in the models.

Nowadays coping has received increased attention as one of these intervening variables. However, despite the conviction that the ways in which people cope with stress affect their psychological, physical and social well-being (e.g. Coelho, Hamburg & Adams, 1974; Antonovsky, 1979; Lazarus & Folkman, 1984), little is known about how coping plays this mediating role. The main reason for this is that there is a lack of consensus about how to measure coping. In other words, certain confusion exists as to what is meant by coping and how it functions in the process of adaptation.

Coping, like the concept of stress, has been used as an umbrella term encompassing a wide range of variables. At least three broad categories of coping variables have been distinguished: traits, styles and processes (Menaghan, 1983; Lazarus & Folkman, 1984; Cohen, 1987). Coping traits refer to the characteristics of people that dispose them to react in certain ways. Styles are similar, differing primarily in degree; they refer to broad ways of approaching problems. Coping processes are, instead, concerned with what the person actually thinks or does in a stressful situation. They are examined in a specific context and when a stressful encounter unfolds, the changes in coping thoughts and acts are the object of interest.

The main aim of coping — defined as a trait, style or process — is to master, tolerate, minimize, or reduce external and internal demands and conflicts among them. Lazarus and Folkman (1984) comment that both research types — dispositional and process-oriented — of stress and coping are needed. The choice of the research type leads to different levels of analysis. The dispositional approach leads to macroanalysis and coping is treated globally emphasizing its structure, i.e. the emphasis is put on classifying people and their coping patterns. At the level of microanalysis the process-oriented approach produces more exact information about the phenomenon and how it changes. Both levels of analysis are necessary because coping includes static and dynamic elements.

## 2.3 Methodological problems of stress research

According to Kasl (1983) research on stress and illness in humans has failed to provide the cumulative insights into the stress process that one would expect from a sizable and rapidly growing literature. This state of affairs is explained by several shortcomings in research, of which the absence of a comprehensive theory prior to the initiation of data collection is the most primary (Leventhal & Tomarken, 1987). Others — methodological problems — grow out of it; namely, the non-independence of the operations used to assess the stressor, the stress response, the disease; the inability to control or assess multiple levels of response; and the lack of a time frame for plausible inference. Although it may be a rare study that can avoid all these shortcomings, more specificity and causality can be reached in studies by paying attention to them.

Bailey and Bhagat (1987) have stated that the main problem in stress research is that both independent and dependent variables are measured with the same method, usually a self-report instrument. This is not to say that self-report measures do not contribute to sound, theoretically correct and rigorous stress research. However, it is proposed that stress research utilizing a multi-method approach to measurement would add considerable methodological robustness to strategies in stress research.

The main threat to validity associated with the single-method approach is due to a common method variance. Some basic problems (e.g. Bailey & Bhagat, 1987) are response styles (habitual ways of answering questions), reactivity (alteration of a response by the respondent because of his or her knowledge of being observed or assessed), and a consistency effect (tendency to be logical in statements about things). Despite the awareness of these biases it is obvious that because of the very nature of the self-report instruments, it is impossible to eliminate all such biases. Thus, additional measures, e.g. records of archives, observation and physiological indicators, are needed to improve methodological robustness.



Although Cox (1985) states that the measurement of stress at work must focus on the individual's psychological state and places greater trust in the development of reliable and valid methods for obtaining subjective stress data, the use of physiological indicators of job stress is on the increase. Various physiological measures have been utilized in stress research, e.g. cardiovascular symptoms, primarily increased heart rate and blood pressure; gastrointestinal symptoms and diseases, primarily peptic ulcer; muscular tonus measured by electromyographic techniques; biochemical symptoms, such as abnormal levels of uric acid, blood sugar, cholesterol, steroid hormones (especially cortisol), and most of all, catecholamines (especially adrenaline and noradrenaline).

As Ursin (1982) states, a good marker of "stress", i.e. a marker of disease risk, is not offered by any simple physiological measurement. Cox (1985) also concludes that there cannot be direct physiological measures of stress, only physiological correlates. Repeated physiological measurements combined with psychological measurements represent an improvement, but there is still no valid disease risk indicator. According to Ursin (1982, 1984) immunoglobulins may represent a valid stress marker since they react slowly and for a long time. Therefore, they may represent an integrated function of sustained activation over prolonged time which may produce somatic changes.

## 2.4 Catecholamines and stress

The sensitivity of the sympathetic-adrenal medullary system to both psychological and physical factors was first demonstrated by Walter B. Cannon in the early 1930's. His emergency function theory of adrenal-medullary activity states that the autonomic responses serve to prepare the organism for fight or flight. These responses, e.g. increased blood pressure and the availability of glucose, are involved in the human body's response to the psychosocial demands of modern society and it was these responses that also helped our ancestors to survive.

Later laboratory and field research has shown increased catecholamine output in subjects exposed to a variety of stressors, including noise (Lundberg & Frankenhaeuser, 1978), parachute jumping (Ursin, Baade & Levine, 1978), different examinations (Frankenhaeuser et al., 1978; Johansson, Collins & Collins, 1983; Herbert et al., 1986), mental tasks (Collins & Frankenhaeuser, 1978; Forsman, 1981), mechanized work (Frankenhaeuser & Gardell, 1976; Johansson, Aronsson & Lindström, 1978), office work (Rissler & Elgerot, 1978, 1980), police work (Pollack & Steklis, 1986) and so forth.

Of the two amines, adrenaline is more sensitive to psychological stress. The output of noradrenaline may also increase under psychological stress,

but only when stress is intense. Noradrenaline excretion increases mainly in response to physical stress. A hypothesis put forward in the early days of psychoendocrinology was that adrenaline and noradrenaline were released selectively under different emotional experiences (Ax, 1953; Funkenstein, 1956). Nowadays, it has been confirmed that the secretion patterns tend to be rather similar, irrespective of the quality or nature of the emotional experience. However, there is certain selectivity in the responses as Frankenhaeuser (1980, 1982, 1986) has evidenced. Two components of the stress experience, effort and distress, seem to determine the endocrine response.

The effort factor involves elements of interest, engagement, and determination. Effort implies an active way of coping, a striving to gain and maintain control. The distress factor involves elements of dissatisfaction, boredom, uncertainty, and anxiety. It is associated with a passive attitude and feelings of helplessness. Situations described by effort with or without distress may be accompanied by increased catecholamine excretion. Furthermore, situations with distress without effort are accompanied by increased cortisol secretion, but the levels of catecholamines may not necessarily be elevated.

These results are based on investigations concerning acute or severe stress and simultaneous hormone excretion. Although part of the studies deal with stress situations of low severity, they also examine concurrent relationships: emotional experiences and catecholamine excretion are measured at the same time. However, at work it is often a question of chronic stress which has after-effects extending beyond working hours. On one hand, it is known that urinary catecholamines are appropriate for measuring chronic stress (Christie & Woodman, 1980; Ward & Mefford, 1985; Bailey & Bhagat, 1987; Steptoe, 1987), and on the other, the evidence indicates that night-rest urinary excretion of catecholamines could also be used as an index of "unwinding" and sustained work stress.

For instance, two Finnish studies (Mattila, 1972; Mattila & Vainikka, 1972) demonstrated a positive correlation between the physical work strain of a work day and the rate of catecholamine excretion during the following night. Mental strain has also been shown to manifest itself in elevated rest levels (Melton et al., 1976; Rissler & Elgerot, 1978, 1980). In a population field study (Jenner et al., 1980; Harrison et al., 1981; Reynolds et al., 1981), various significant, although weak, associations between catecholamine excretion rates and different aspects of lifestyle and subjective sense of well-being were detected particularly for the Saturday-Sunday night among women. Among men, however, the variance in daytime excretion on a workday could be mainly explained by these variables together with occupational status.

Despite this evidence, there are certain problems concerning the use

of night-rest catecholamine excretion as an indicator of accumulated stress. For instance, it has been shown that elevated catecholamine excretion is typical of disturbed sleep (Sudo, 1980; Torsvall et al., 1981). It was unclear whether the activity implied by poor sleep caused an elevation in the excretion or whether poor sleep was caused by an elevated hormone excretion. On the other hand, Jenner et al. (1985) did not find any evidence of associations between hormone excretion (adrenaline, noradrenaline, cortisol, cortisone) and sleep latency or quality in either sex.

It is known, however, that waking up during the night has an effect on concurrent excretion. The circadian rhythm shown by urinary catecholamine excretion in normal life with night rest (low excretion rate during night time) is not seen at all in noradrenaline if the subjects are kept awake (Åkerstedt, 1979). Even if a pronounced circadian rhythm in adrenaline excretion also prevails during a 72-hour sleep deprivation, the night level during waking is about twice the night level during sleep.

There are also other potential methodological problems concerning the use of catecholamines as a stress indicator (see Levi, 1972; Fried et al., 1984; Ward & Mefford, 1985). The basic reason for these problems is that catecholamine levels are sensitive to several factors besides stress. For instance, such individual factors as sex, age and personality characteristics affect catecholamine production. In addition, there are factors which have a chronic effect on catecholamine levels (daily and monthly cycles and possibly also a seasonal variation), and factors that dramatically affect catecholamine release for several hours or days (caffeine, alcohol, nicotine, exercise). Finally, there are a number of factors that acutely affect catecholamines (movement and posture changes, food and drink intake). However as Fried et al. (1984) confirm, these sets of factors appear to be more obvious in regard to cross-sectional studies. Longitudinal studies provide some important methodological advantages in reducing or eliminating the effects of these confounding factors.

## 2.5 Occupational stress — teacher stress as an example

Stress at work is one of the fields which is of interest from a theoretical and an empirical point of view. The importance of work as a possible source of stress can be drawn from the large role that work plays in the lives of adults: the substantial amount of time that most people spend at work, the importance of work as a fundamental means for implementing and fulfilling personal aspirations and expectations, and the possible legal and productivity implications of work stress for organizations.

The importance of studying stress in the work domain has been

established. Although research investigating the effects of job stress on performance and productivity began in the early 1950's, programs to improve employee relations and health and to reduce the effects of stressors began much later. Nevertheless, stressful conditions at work have been under recent scrutiny, and a significant trend toward greater corporate involvement in promoting employee health through a variety of stress-reducing programs has become more common.

Research following stress tradition has been conducted concerning both blue collar (Cooper & Smith, 1985) and white collar (Cooper & Payne, 1978; Cooper & Marshall, 1980) occupations. In recent years, increasing attention has been paid to health professions and human service occupations (e.g. Cherniss, 1980; Farber, 1983; Payne & Firth-Cozens, 1987) and among them to teachers (Dunham, 1984; Humphrey & Humphrey, 1986). Studies on occupational stress and health in the service sector are of academic interest for two reasons (Johansson, 1987). First, the general understanding of the nature and effects of occupational stress has been built up on studies in the primary (extractive) and secondary (manufacturing) sectors. Second, the majority of those working and studied in the primary and secondary sectors have been men, while many of those working in the tertiary (service) sector are women. Both these points must be taken into account when interpreting studies on stress in schools in the wider context of occupational stress and health.

Teacher stress has been studied without interruption since the early 1930's (see Mäkinen, 1982). According to Sutton (1984), the number of teacher stress studies is few; however, when compared to other areas of working life, they are contributing to a slow improvement in teachers' working conditions. Teachers' well-being is not of interest only for their own sake but also for their pupils' sake: the teacher-pupil interaction with intensive relations of long duration is a crucial aspect of teachers' and their pupils' daily work and well-being. A teacher's problems will have a negative influence on the intellectual, social and emotional development of her/his pupils in the classroom.

To a certain degree the research has begun to be repetitive, but new research themes have also emerged. In the early studies three types of themes were the most popular ones: the magnitude, the sources and the correlates of teacher stress. Mäkinen (1982) presented a quite detailed review of the studies done on these three topics in Finland and in other countries in the years 1950-1980. Therefore, only a brief summary of the earlier results is presented first in this paper, after which this paper will concentrate on the new themes that have emerged mainly after 1980; namely, the notion of the coping process and resources and the concept of stress as a process proceeding in time and ending (because of successful coping and recovery) without any abnormal end states.

### 2.5.1 Traditional research themes of teacher stress

#### Magnitude of stress

According to Mäkinen (1982), 5 % of the Finnish comprehensive and upper secondary school teachers were seriously disappointed in their career and 23 % were disappointed to some extent. About 3 % had entertained concrete plans for a change of occupation. 30 % of the teachers described themselves as being so depressed and stressed by professional worries after the working day that it hampered their participation, e.g. in leisure time activities. The health of the teachers was good when compared to the population at large. 74 % of the teachers considered their state of health good. Their rate of absence from work because of illness was also lower than that of the population in general. The most common symptoms of psychological and psychosomatic stress in the teachers were tiredness (reported by 35 %), depression, insomnia, restlessness, and indisposition (9–15 %). Pain in the back and in the neck and headache (7–19 %) were the most frequent of the somatic symptoms.

Nieminen (1984), when studying Finnish comprehensive school teachers who graduated 20 years ago, found that 11 % (n=10) of the surveyed 93 teachers had changed their occupation since the academic years. Job satisfaction variables indicated that teachers generally expressed contentment with their job and its human relations. The teachers' mental health turned out to be at the same level as in some Finnish student surveys, but in the mental health survey of Väisänen (1975) which represented the entire Finnish population, the percentage of healthy subjects was notably greater. The teachers' mental health in the study of Nieminen was evaluated (based on the interview data) as follows: 17 % of the teachers were classified as completely healthy, 34 % as having slight difficulties in human relations, 35 % as having distinct difficulties in human relations, 9 % as neurotic, and 5 % as borderline, psychotic, or as possessing severe character disorders. The criteria by which Nieminen performed this classification can be questioned: did she overemphasize the existence of problems and forget the fact that to be healthy did not mean to be without any problems? Parallels cannot be drawn between these estimates and those of Mäkinen's (1982), because his results were based on self-reports of teachers concerning their health.

In sum, the magnitude of teacher stress varies according to the criteria (psychological, behavioral, psychosomatic or health variables) used. When also summarizing other recent Finnish reviews on the topic (Nikkanen, 1979; Aho, 1981; Ojanen, 1982; Stjernberg, 1986) the final outcome was

the same: a minority — some 10–20 % — of primary and secondary school teachers seemed to be overloaded or stressed by their work to a degree that implied serious impairment of well-being or psychosomatic health. However, higher percentages also appeared in the same studies when a very loose criterion of stress (proportion of those who report that they at least sometimes experience stress) was used. The studies on teacher stress conducted in other countries (e.g. Coates & Thoresen, 1976; Keavney & Sinclair, 1978; Kyriacou & Sutcliffe, 1978; Veenman, 1984) resulted in these same figures of prevalence. Corresponding figures have also been reported concerning other occupations in a number of economic sectors in Finland (Kalimo, 1985).

### Sources of stress

Broadly speaking, research results on the sources of stress from different times and countries tend to be quite similar, especially when summarized in a general form. This, however, is not very surprising: teacher's work is quite universal; it contains interaction with pupils, other teachers, pupils' parents, school administration. Teaching also depends on the school buildings and some educational resources, etc.

Citing Coates and Thoresen (1976), Dunham (1976), Kyriacou and Sutcliffe (1978), Phillips and Lee (1980), Tellenback, Brenner and Löfgren (1983), Mykletun (1985), Blase (1986), and Dworkin, Haney and Telschow (1988), the sources of stress, as perceived and reported by teachers themselves, quite consistently include the following: the quality of social interaction at work (with pupils and colleagues); time demands and the amount of work; inadequacies in the material working environment and prerequisites of work; and problems related to societal status, professional pride and salary.

By their nature, as Mäkinen (1982) comments, these studies in which perceived origins of stress are studied, represent explorations into the subjective or perceived worlds of teachers, or more accurately, into what teachers are able and willing to report about experiences and interpretations concerning their work and worries. Perhaps that is why stress is often reported to be due to sources outside the teacher himself. For instance, such sources of teacher stress as one's own unfitness for the teaching profession or inadequacies in one's own education are quite rare.

### Correlates of teacher stress

The variables empirically tested for correlations with indicators of stress have represented, on one hand subjectively reported sources of stress, or on the other, 'objective' characteristics of a person or his work and

working conditions. The meaning and the interpretation of the former correlations is problematic, especially when the stress indicators also consist of subjective self-reports. Despite the interpretation problems involved here it seems warranted to conclude (e.g. Mäkinen, 1982; Tellenback, Brenner & Löfgren, 1983; Brenner, Sörbom & Wallius, 1985; Mykletun, 1985) that the strongest and most consistent predictors of a teacher's psychological well-being at work as well as outside working life are the quality of interpersonal relations, especially with pupils but also with colleagues and supervisors.

Studies on 'objective' correlates of teacher stress are somewhat easier to interpret in terms of cause and effect: objective characteristics of a person or his work present more probable 'causes' and perceived stresses or other stress variables present more 'effects' than vice versa. Of the 'objective' correlates only those which have repeatedly been shown to have some direct effect on the well-being of teachers are mentioned here; namely, two characteristics of work — teaching level and the age of the pupils taught — and two of teachers — teacher's age and sex.

Typically, elementary school teachers are somewhat more satisfied and less strained than secondary school teachers (e.g. Pratt, 1978; Lundberg, 1981; Mäkinen, 1982). These differences are partly explained by the age and the age-connected behavior of the pupils. A majority of the studies (e.g. Aho, 1981; Mäkinen, 1982; Ojanen, 1982; Voutilainen, 1982) on the effects of teacher's age (which is often confounded with work experience) point to the conclusion that younger teachers tend to be more stressed and dissatisfied and exhibit higher rates of sickness absence and turnover than older teachers. Most studies tend to suggest somewhat better satisfaction among female than male teachers (e.g. Ruohotie, 1980; Voutilainen, 1982). However, female teachers estimate their psychological and physical well-being as poorer than male teachers (e.g. Aho, 1981; Mäkinen, 1982).

### **2.5.2 New research themes of teacher stress**

Stress theories include, besides sources of stress and their manifestations, two additional aspects, both of them essential parts already in the early writings of Cannon and Selye, namely the notion of the coping process and resources and the concept of stress as a process which proceeds in time and usually ends (because of successful coping and recovery) without any abnormal end states. By ignoring these factors one easily arrives at the two variable designs — cause and effect in the sense criticized, e.g. by Lazarus and Launier (1978) and Jenkins (1979) — that can hardly show any strong associations or, consequently, lead to any fruitful applications. Coping and stress as a process proceeding in time have been recently started to be taken more and more into account in the field of stress

research. This is also true about the research on teacher stress.

Coping research concerning teacher stress has mainly (e.g. Kyriacou, 1980b; Needle et al., 1981; Ojanen, 1982) dealt with the question of what teachers do to deal with stress on the job (e.g. talk about the problems, become more involved in after work activities). The question of how effective these coping strategies are in reducing stress has only recently begun to be addressed by researchers. Rajala (1986, 1988) in Finland and Brenner, Sörbom and Wallius (1985) in Sweden have considered this problem of effectiveness. Some programs to treat teacher stress have also emerged, for instance by von Scheele (1986). In addition, a teacher's personality and social support as coping resources have been studied to some extent (e.g. Kyriacou & Sutcliffe, 1979; Kyriacou, 1980a; Aho, 1981; Tellenback, 1982; Brenner et al., 1985; Nash, 1986; Holt, Fine & Tollefson, 1987).

The idea of Rajala's (1986) study was to explore the effectiveness of coping strategies associated with the increased stress over the autumn term among comprehensive (primary) school teachers (together about 800). Teacher stress and coping efforts (including problem solving, keeping things at a distance, seeking support) were measured twice during the autumn term of 1985. Preliminary results ( $N=168$ ) indicated that while considering the effectiveness of coping, short-term emotional responses (threat and challenge emotions) mediated the effects of coping efforts. By and large, the emotional responses were associated with short-term strains (e.g. feelings of anxiousness, depression) which in turn were related to long-term strains, e.g. job dissatisfaction. Coping efforts were not directly associated with the short- or long-term strains.

The study by Brenner et al. (1985) consisted of two measurements: a questionnaire given during the middle of the first term (autumn) and at the end of the last term (spring). The teachers ( $N=63$ ) were working in a Swedish comprehensive school. It was found that coping mechanisms — problem solving and emotional approaches — explained only minor transitions in stress state from term I to term II, not the major difference between the stressed and nonstressed teachers. The authors concluded that the major part of successful coping seemed to take place during the first half of the school year; later only minor changes were noticed.

On the basis of these two studies, coping does not seem to be very effective when dealing with occupational stress. Pearlin and Schooler (1978) found that coping interventions were most effective when dealing with problems within close interpersonal role areas, e.g. marriage and child rearing. Problems at work were found to be resistant to amelioration through coping efforts and regarded therefore as impersonal as well as reflecting chronic nature of problems in the work context. Menaghan and Merves (1984) also emphasized that occupational problems may not be



easily resolved by individual efforts alone. However, in the study reported by Folkman (1982), about 30 % of the problems at work were appraised as modifiable, and in most cases interpersonal. These findings were not consistent with Pearlin and Schooler's. Also, von Scheele (1986) found that by a multifaceted treatment strategy (including relaxed jogging/walking training, and cognitive and communication training) teachers improved in stress control, that is, in positive emotional involvement and coping effectiveness.

Besides representing coping research, the studies by Rajala (1986, 1988) and Brenner et al. (1985) are examples of recently reported longitudinal studies on teacher stress, i.e. studies in which stress is examined as a process proceeding in time. The study by Brenner et al. showed that in a Swedish comprehensive school most teachers changed very little in perceived stress over the school year. Conversely, preliminary results from Rajala's study concerning Finnish primary school teachers indicated that their stress level rose from the end of August to the end of October.

In addition to these, other longitudinal studies on teacher stress have been reported in the USA. A couple of them deal with special teacher groups (DePaepe, French & Lavay, 1985; Wade, Cooley & Savicki, 1986), and one with elementary school teachers (Fleischut, 1985). The first two studies showed that among special physical educators and teachers for emotionally disturbed children and adolescents burnout levels (measured by MBI 2-3 times a year, Maslach & Jackson, 1981) were quite high and stable over one year.

The purpose of Fleischut's (1985) study was to investigate the origins and the intensity of job-related stress of elementary school teachers at five selected intervals during the course of one school year (1981-1982). The responses were given in September, November, January, March and May by using the same questionnaire. The subjects (N=81) for this study were teachers at seven elementary schools in Pennsylvania. The results indicated that the teachers experienced less stress at the start of the school year (September) and after Christmas Vacation (January) than during November, March and May. The surveys indicated that the actual stress levels increased during the first part of the school year (September to November), decreased after Christmas Vacation (January), then steadily increased through March to another high point in May. Also, the origins of stress reported by the subjects varied significantly at each of the five intervals studied. However, as a source of stress the emphasis was apparently placed on curriculum and students in all five months of the study.

## 2.6 A brief summary of the framework

The framework of this study was based on the reviewed literature and on the general stress research tradition followed in work stress studies. Special emphasis was put on the following theoretical perspectives:

Stress is a product of the stimulus (how it is perceived and thought about), the responses to cope with it (responses to change the situation or to deny or alter its interpretation), and the appraisal of outcomes (successful or unsuccessful). The appraisal is due to the characteristics of one's resources and one's environment, i.e. person and situation factors. This means that individual susceptibility, mediated through cognitive appraisal and coping, is an important factor determining the experience of stress.

Two other important factors must also be mentioned. The first has to do with time: it is clear that stress operates over time. A time frame provides knowledge of the duration and the process of stress. In addition, the longitudinal method of stress research presents the possibility to study stress as a continuous process of strain and recovery. The strength of stress responses can be measured or defined as a function of the time needed to recover from them; stress can accumulate and become chronic — especially as a result of insufficient recovery during the accumulation process. In everyday work and life, it is accumulative, chronic, rather than acute stress that is conducive to ill health (cf. Cameron, 1974; Christie, 1975; Christie & McBearty, 1979; Ursin, 1980; Frankenhaeuser, 1981; Ursin, Murison & Knardahl, 1983).

Second, analysis at more than one level is needed: a biopsychosocial solution enhances the power of stress analysis. As was stated above, the speed with which a person "unwinds" after stressful transactions with his environment will influence the total wear and tear of the organism. Thus, the excretion of catecholamines during night sleep is interrelated with the question of whether an elevated sympathoadrenomedullary activity during night rest functions as a mediating mechanism in the development of stress diseases.

According to these perspectives, teacher stress was studied as an accumulation/recovery process over time. One school year was regarded as a meaningful time unit for analysis, within which the work and the rest cycle of the profession was studied. The school year in Finland is at present 190 days long from about August 15th to about May 31st, with three longer breaks: 10 days around Christmas, 8 days in February-March and 5 days at Easter. Teachers were assumed to begin the school year in August practically without any feelings of work stress because of the long summer holiday.

### 3 PURPOSE OF THE STUDY

The general purpose of the study was to explore the psychological and somatic well-being of teachers over one school year in order to study the accumulation of and the recovery from stress as well as factors which contribute to both of these. The overall objectives of the study were divided into three groups. First, the purpose was to study how teacher stress proceeded in time — during one school year — and how good a possibility the profession offered for annual recovery from stress. Secondly, the aim was to answer the questions of whether teacher stress manifested itself in various forms of process and what the role of coping was in the process, i.e. to study the interindividual differences in stress and coping among teachers. Thirdly, the relationship between teacher stress and urinary excretion of catecholamines during night rest was studied in order to find out its usefulness as an index of accumulated stress.

The specific questions (related to the three research themes mentioned above) under study were:

#### I Teacher stress as an accumulation/recovery process

- in what way does the level of teacher stress vary over the school year as indicated by self-rated moods, sexual activity, occurrence of illnesses and medicine intake,
- in what way do certain variables assumed to affect the teacher stress process vary over the school year (amount of work, night rest and free time; social and physical free time activities; interpersonal relations at work and at home),
- what is the relation between the indicators of stress and the variables to be referred to as the co-factors of stress (mentioned above),
- how stable is the stress process during the school year and how do

the rest periods effect the predictability of the process,

- how useful are LISREL models in the analysis of the structural features of the stress process, and
- do the origins of stress vary over the autumn term at six selected time intervals.

## **II Interindividual differences in stress and coping**

- does teacher stress, expressed by subjective mood ratings, manifest itself in various forms of process,
- do the teacher groups with different stress processes vary in any background, personality or coping characteristics, and
- what kinds of coping styles can be found among teachers and how are they manifested in the stress process.

## **III Stress and night-rest urinary excretion of catecholamines**

- how do the subjective stress indicators and catecholamine excretion during night rest correlate with each other at different points of the autumn term,
- how is the subjective stress process over the autumn term reflected in the night-time catecholamine excretion, and
- to what extent are the differences in catecholamine excretion explained by some characteristics of teachers (sex, age and personality), aspects of free time (amount of physical and social activities and use of stimulants) and work (amount of work, quality of social interaction).

## 4 MATERIAL AND METHODS

### 4.1 Subjects

A sample of 564 teachers, stratified for sex, school level and municipality, was drawn from the membership file of the local trade unions of teachers (primary and secondary) in five municipalities of varying size and density of population. The number of teachers in this target population was 1875 in January of 1983. The subjects in the initial sample were contacted by a letter and asked to volunteer in a longitudinal study on teachers' work, stress and health during the period of April, 1983 to May, 1984. Besides the purpose of the study, the letter informed the teachers about the labour implied by the participation, e.g. repeated delivery of urine samples and questionnaire answers.

Only 187 teachers — 33.2 % of the subjects contacted — agreed to participate. However, the initial aim to get about 200 teachers to take part into the study was achieved and at the same the representation of important subgroups in the final sample was ascertained. The analyses concerning possible selectivity of the sample indicated that (1) female, (2) middle-aged (40–49 year olds), (3) special teachers and (4) teachers from the city of Tampere had agreed to participate in the study willingly. Information on the population, the initial and final sample is given in Table 1.

All the teachers contacted were asked for the reason for possible refusal, which was given by 166 teachers of the 377 refusees. Eight of them did not work in the position the register showed, 59 announced their work was going to terminate before the study and 99 gave hurry and lack of time for reasons. A great number of those teachers appealing to hurry could refer to stress as a general limit to the participation. The conclusion was that the sample was not representative of all teachers and was probably selective also with regard to the research variables. This is true in most volunteer populations as Levi (1972) has evidenced.

Table 1. Study population and sample.

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**Population N=1875**

- **School level:** 5 % (91) special teachers, 42 % (787) teachers of grades 1 – 6, 40 % (747) of grades 7 – 9, and 13 % (250) of grades 10 –12
- **Municipality:** 65 % (1218) from the city of Tampere, 28 % (527) from the city of Jyväskylä, 3 % (62) from the commune of Korpilahti, 2 % (29) from the commune of Muurame, and 2 % (39) from the commune of Säynätsalo

**Sample N=564**

- **Sex:** 56 % (314) females, 44 % (250) males
- **Age:** mean = 44 years, SD = 8.9 years, range 25 – 65 years
- **School level:** 16 % (88) special teachers, 33 % (185) teachers of grades 1 – 6, 27 % (154) of grades 7 – 9, and 24 % (137) of grades 10 – 12
- **Municipality:** 33 % (188) from Tampere, 44 % (246) from Jyväskylä, 11 % (62) from Korpilahti, 5 % (29) from Muurame, and 7 % (39) from Säynätsalo

**Final Sample N=187**

- **Sex:** 60 % (113) females, 40 % (74) males
  - **Age:** mean = 44 years, SD = 7.4 years, range 25 – 59 years
  - **School level:** 22 % (42) special teachers, 27 % (50) teachers of grades 1 – 6, 28 % (52) of grades 7 – 9, and 23 % (43) of grades 10 – 12
  - **Municipality:** 47 % (88) from Tampere, 31 % (57) from Jyväskylä, 11 % (21) from Korpilahti, 6 % (11) from Muurame, and 5 % (10) from Säynätsalo
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One special problem concerning longitudinal studies is "experimental mortality", which is caused by e.g. subjects' lack of interest, active refusal and change of residence. There were also problems in sample maintenance in this study: 23 subjects dropped out of the study during its course. Most of them did not give a reason for their behavior. Another problem was subjects' nonattendance on some individual measurement occasions. On each research day, there were 15 subjects on the average (range 7–24) not attending the study because they had forgotten the research day or because they were not present at school on some research days.

**Table 2.** Subjects in articles (I–V) in relation to some background variables (%).

Variable	I N=187	II N=142	III N=142	IV N=153	V N=137
<b>Sex</b>					
Female	60	63	63	63	62
Male	40	37	37	37	38
<b>School level</b>					
Grades 1–6	46	43	43	43	42
Grades 7–9	31	32	32	34	34
Grades 10–12	23	25	25	23	24
<b>Municipality</b>					
Tampere	47	47	47	49	47
Jyväskylä	31	32	32	31	34
Others	22	21	21	20	19

Thus, a large number of missing values was typical of the research data. This was the basic reason for the varying number of the subjects (N=137–187) in the articles (I–V). Also, the principle to utilize the research material as best as possible led to this outcome. In addition, in part of the studies the statistical method (e.g. cluster analysis) required list-wise deletion of cases, and the number of subjects decreased. The large number of missing values was especially a problem with the urine samples, although catecholamine data were completed by regression estimates from an incomplete sample (Orchard & Woodbury, 1972). When looking at the background variables, the subjects did not differ statistically significantly from each other in the articles (Table 2).

## 4.2 Methods of data collection

Two basically different types of methods were used for the data collection, questionnaires and laboratory measurements. These measurements were repeated; the questionnaire data and the urine samples were collected from the same subjects 17 times during a period of 14 months, from April 1983 to May 1984. Two of them took place in June during the summer holidays (about 50 volunteer teachers participated in these summer measurements), 8 represented weekends or other holidays (*WE*), and 7 were workdays (*WD*) during the school year (Table 3). The background variables of the study were based on personnel records data and on a questionnaire answered in the autumn of 1983.

**Table 3.** The fixed days of repeated measurements.

Holidays	No.	Days of measurements
		<b>The spring term of 1983</b>
	1 <i>WE</i>	Monday, April 25th
	2 <i>WD</i>	Friday, May 13th
	3 <i>WE</i>	Monday, May 23rd
		<b>The summer holidays of 1983</b>
Summer holidays	4	Monday, June 6th
1.6.-15.8.	5	Friday, June 17th
		<b>The autumn term of 1983</b>
	6 <i>WD</i>	Friday, September 2nd
	7 <i>WE</i>	Monday, September 26th
	8 <i>WD</i>	Friday, October 14th
	9 <i>WE</i>	Monday, November 7th
	10 <i>WD</i>	Friday, December 2nd
Christmas holidays	11 <i>WE</i>	Monday, December 19th
22.12.-1.1.		<b>The spring term of 1984</b>
	12 <i>WE</i>	Monday, January 9th
Sports holidays	13 <i>WD</i>	Friday, February 10th
27.2.-4.3.	14 <i>WE</i>	Monday, March 5th
Easter holidays	15 <i>WD</i>	Friday, March 30th
20.4.-23.4.	16 <i>WE</i>	Tuesday, April 24th
	17 <i>WD</i>	Friday, May 18th

The research material on which each article (I-V) was based was as follows:

- I Repeated questionnaires during the whole follow-up time, 17 measurements (1-17)
- II Repeated questionnaires during the autumn term, 6 measurements (6-11)
- III Repeated questionnaires during the school year, 12 measurements (6-17)
- IV Background questionnaire and repeated questionnaires during the autumn term, 6 measurements (6-11)
- V Repeated questionnaires and laboratory measurements during the autumn term, 6 measurements (6-11)



## Repeated questionnaires

Repeated questionnaires were formulated separately for the workday and weekend measurements. In the construction of the questionnaires\*, one starting point was to briefly cover all the important aspects of teacher stress process: the origins and manifestations of teacher stress and to some extent also the intervening variables in the process.

The structure and the contents of the questionnaires are represented by the following variables (further information in Appendix I):

### *Time budget variables*

The questionnaires contained direct questions about the teachers' time budget which is represented by the following variables expressed in hours per day: Total amount of professional work, Classroom hours, Work outside the classroom, Totally free time for personal use, the Amount of night time rest. In addition, the number of hours per day spent on physical and social free-time activities formed the variables Physical recreation activities and Social recreation activities. The workday measurements of all these variables were based on the means of the workdays Monday through Thursday, while the weekend values were the means of the Saturday and the Sunday in question.

### *Social relations variables*

The subjects rated the quality of their social relations at home and at school. The social relations variables, Pupil motivation, Pupil conduct, Colleague relations, were based on the subjects' global rating of these conditions "during the present school week" or in the case of the weekend measurements, "during the preceding school week". The ratings of the Home relations, instead, were given as concerning "the present school week" or "the present weekend". All the ratings were made on a scale from one to four.

### *The use of stimulants*

The variables of Coffee consumption (cups per the day preceding each research day), Smoking (cigarettes per the day preceding each research day), and Alcohol consumption (evaluated on a scale from 0 (=not at all) to 4 (=over 12 drinks) on three or four preceding days) were used to describe the use of stimulants.

### *The health variables*

The subjects were asked to list any disease, illness or symptom they had suffered from as well as any medicine they had taken "during the

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\* The questionnaires are available on request from the author.

present school week" or "during the present weekend". Both of these were recoded dichotomously none/one-or-more to obtain the variables Health complaints and Medicine intake. In addition, the rate of Sickness absence "during the present school week" or "during the preceding school week" was obtained.

### *The mood variables*

The mood variables were based on a set of eight five-point rating scales of the subjects' "mood and condition during the present week" or "during the present weekend". Based on a factor analysis of the scales, four mood variables were formed (each containing one to three subscales): Anxiety (anxiety, irritability), Depression (depression, helplessness, exhaustion), Strain (distress, hurry), and Sexual passivity.

The assessment of the reliability of these sum scales was based on the assumption that all the items of the scale were parallel indicators of the state in question. Hence the coefficient alpha, which reflects the internal consistency of the items of the sum scale, was chosen as the coefficient of reliability of these scales. The alpha coefficients of the scales (medians from the values of the first three measurement occasions) were as follows: Anxiety 0.79, Depression 0.81, Strain 0.59.

In addition, in some analyses a score for feelings of stress computed by summing the ratings of six variables — anxiety, irritability, depression, helplessness, exhaustion, and distress — was in use. The score was tested for internal consistency using Cronbach's alpha for the 12 measurements during the school year of 1983–1984. The coefficients varied between 0.81 and 0.88.

## **Urine samples and analysis**

The subjects were supplied with 1 000 ml plastic bottles containing 2 ml of 6N HCl and instructed

- to void (and discard) urine immediately prior to going to bed the night specified and to record the time of doing this,
- to collect a complete urine sample (possibly during the night and) on arising and to record the time of morning urination, and
- to bring the sample to their school the same morning.

The instructions stressed the importance of collecting all urine voided during the night and on arising as well as that of getting the bladder totally empty before going to bed and in the morning. The subjects were also asked to record details of coffee, alcohol and tobacco consumed during a few days preceding research nights. In addition, the teachers evaluated the quality of sleep during the research nights on the scale from one (very good) to five (very poor).

The samples were collected from the schools (no later than 1 p.m.) and brought to the laboratory where during the same day,

- the total volume and pH of the samples were recorded,
- if needed, the pH was adjusted by HCl to 3.4 (no later than 8 p.m.) and
- two or three aliquots (50 ml) of each sample were placed in a freezer ( $-20^{\circ}$  C, no later than 9 p.m.).

Urine was kept frozen (for 2 to 8 months) until analysed for free adrenaline and noradrenaline by the technique described by von Euler and Lishajko (1961), using a Perkin-Elmer MPF2A spectrofluorometer. The concentrations of adrenaline and noradrenaline in urine were expressed in ng/ml, and measured in duplicates which intercorrelated for adrenaline at the level of 0.91 and for noradrenaline 0.95. To determine the precision of the method over time standard test series of urine were analysed throughout the laboratory measurements. These analyses showed a coefficient of variation of 4.4 % for adrenaline and 7.6 % for noradrenaline.

By combining the determined catecholamine concentrations with urination time, volume and body weight data excretion rates, expressed in ng/min/kg, were obtained for the night period. For most statistical analyses the positively skewed distributions were normalized by taking lgN values.

## Background questionnaire

The aim of the background questionnaire\* was to obtain information on the teachers' coping resources and strategies and factors contributing to them. The questionnaire contained items concerning the following areas: occupational background (6 items); family and individual conditions (7 items); personality characteristics — neuroticism (10 items), extraversion-introversion (20 items), locus of control (8 items), type A behavior (18 items) — and the ways of coping (26 items).

Neuroticism and extraversion were measured by Eysenck's scales (Eysenck & Eysenck, 1964), locus of control measurements were based on Rotter's (1966), and type A behavior measurements on Jenkins, Rosenman and Friedman's (1967) ideas. The original measures were used in shortened Finnish forms and their reliability by Cronbach's alpha was as follows: Neuroticism 0.78, Extraversion 0.79, Locus of control 0.66, Type A behavior 0.71.

Coping was defined as structural properties which meant that coping referred to stable dispositions of approaching problems. The respondents were asked about their behavior in difficult stress situations in general.

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\* The questionnaire is available on request from the author.

This was assessed with a 26-item self-report measure which contained cognitive, emotional and behavioral strategies people use to manage in stressful situations. Both problem- and emotion-focused forms of coping were included in the item list. The response format was a 5-point Likert scale (5 = used a great deal; 1 = did not use at all). Four coping scales were formed out of the coping items through factor analysis (for further information see Appendix I): emotion escape (8 items), depression-problem solving (5 items), social support (5 items), and conscious suppression (4 items). The coefficient alpha of the coping scales was as follows: Emotion escape 0.62, Depression-problem solving 0.66, Social support 0.65, and Conscious suppression 0.61.

### 4.3 Statistical methods

The statistical analysis of the data contained on one hand, descriptive, and on the other, explanatory analyses. The descriptive analysis was carried out as the first step in the analysis of the data. The results of the descriptive analysis have been previously reported (Kinnunen, 1985; Kinnunen, Mäkinen & Vihko, 1985) and only a summary of those results is given in article I concerning the question of how teacher stress, as indicated by different stress variables, proceeds in time.

The explanatory analyses between the selected variables were done by the LISREL technique (Analysis of linear structural relationships by the method of maximum likelihood, Jöreskog & Sörbom, 1981). First, longitudinal quasi-simplex models of teacher stress and their modifications were constructed within the framework of the LISREL models (Jöreskog, 1970), and secondly, cross-sectional regression models concerning the effects of potential stressors on the state of stress were formed. The results of the constructed models were reported in two separate articles (II, III).

Interindividual differences in stress and coping were analysed by cluster analysis (Wishart, 1978), which is an exploratory method for sorting similar "things" into categories. In this case different stress process and coping types among teachers during the autumn term were examined. These results, which described the subgroups of the sample more thoroughly, were reported in article IV.

The relationships between catecholamine excretion during night rest and subjective stress data were studied cross-sectionally at different times of the term and intra-individually over the term by a clustan program. The findings of these analyses were reported in article V. In addition, the explainability of the level differences in catecholamine excretion was studied using various variables. A detailed description of the statistical methods applied was given in each article in question.

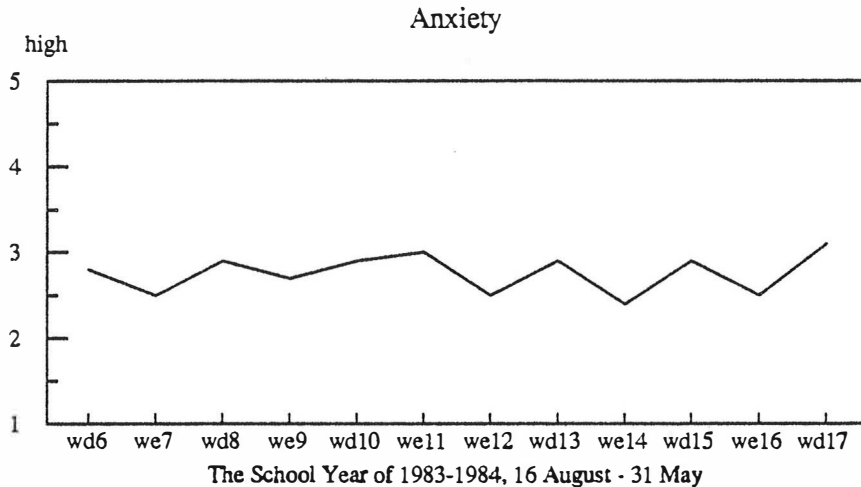
## 5 RESULTS

### 5.1 Teacher stress over a school year (I, II, III)

The aim of the first article (I) was, on one hand, to describe how teacher stress, expressed by different stress indicators (self-rated moods, sexual activity, occurrence of illnesses and medicine intake), proceeds in time. In the analyses special attention was paid to the recovery from and the accumulation of stress, i.e. to the differences in stress levels between workdays and weekends. On the other hand, the role of the co-factors of stress (amount of work, night rest and free time; social and physical free time activities; interpersonal relations at work and at home) as predictors of the stress indicators was of central interest.

As to the variation over the year, the results showed that the amount of stress increased considerably during the second half of the autumn term. Significant recovery took place during Christmas holidays as well as during the two breaks in the spring term, to the effect that no overall accumulation of stress appeared during the spring term. The teacher stress cycle manifested itself in the form of illnesses, medicine intake, anxiety, depression and sexual passivity. The cycle was seen more clearly in the weekend measurements than on workdays, i.e. there was less or no recovery from stress accumulation during the weekends in November-December. In Figure 1 the stress cycle over the school year is described by means of experienced anxiety. In this stress indicator the above mentioned time trend was reflected well.

As for the interindividual differences in stress indicators, the concurrent correlations indicated stronger associations with social relations (up to 0.59) than with the time budget variables (up to 0.40) studied. In respect to the stress indicators, the mood variables were better predicted by the co-factors than the health variables. It seemed that the quality of pupil relations, even without necessarily being the strongest concurrent correlate of stress indicators, also represented a predictive stress factor: less satisfactory interaction with the pupils in the autumn predicted an



**Figure 1.** The stress cycle over the school year illustrated by self-reported anxiety.

increase in the teacher's anxiety, depression and medicine intake in the spring.

In the second article (II) the predictability of the state of teacher stress was studied in a more detailed way. Specifically, the study, using the LISREL models tested the influence of selected variables on the psychological distress of teachers at six time intervals during the autumn term. The LISREL method is by its nature confirmatory, i.e. preliminary hypothesis about the relationships between the variables selected in the model are expected. In this case the selection of the variables to the model was based on the findings in article I. Thus, the proposed regression model included variables concerning the amount of work and the quality of interpersonal relations at school with pupils and colleagues and at home with the family.

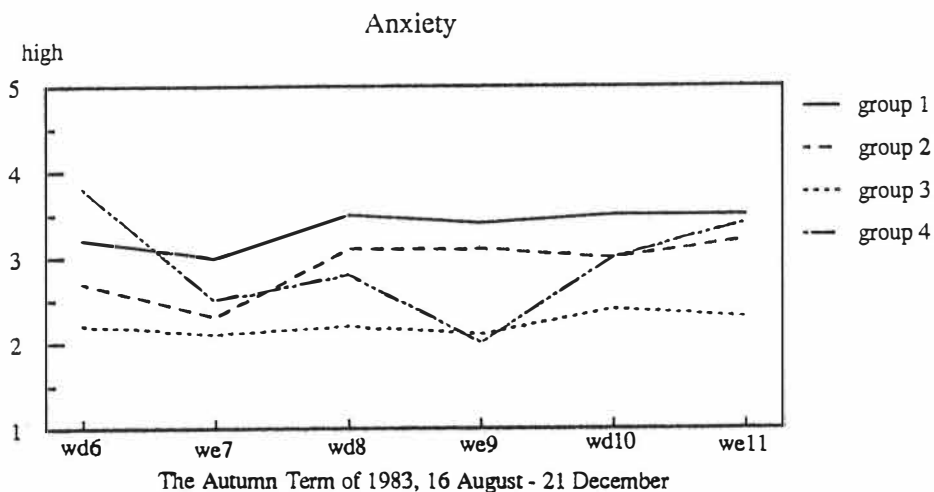
As origins of stress, social relations proved more important than the amount of work. The number of work hours was not significantly associated with stress feelings among the teachers on any measurement occasion. The social relations variables accounted for 16-30 % of the variance in self-reported stress at different points of the autumn term. Home relations had a significant effect on teacher stress on every measurement occasion. In addition, home atmosphere had a true predictive value in explaining stress over time, from the beginning to the end of the autumn term. Besides this stable origin of stress, there were also such origins which changed over the term. At the beginning of the autumn term the quality of colleague relations proved to have a significant influence on teacher stress. After that, in the middle of the term, the

quality of pupil relations was a significant contributor to stress. The variance explained was the lowest at the end of the term, and only home atmosphere yielded a significant regression coefficient.

The predictability of the stress process was the focus of further interest in the third article (III). In this article the stability and the change of the stress process were examined by assessing the predictability of the stress ratings throughout the school year of 1983-1984. The aim was to predict the course of the process solely on the basis of the stress variables. In this case, stress was analysed at the psychological level as emotional distress. The methodological purpose was to evaluate the usefulness of the LISREL models in the analysis of the structural features of the stress process. Longitudinal quasi-simplex models and their modifications of teacher stress over a school year were estimated and tested by the LISREL V-program.

All the stress data were analysed simultaneously in a statistically efficient way by using the quasi-simplex models and their modifications. According to the constructed models, teacher stress was a stable process during the terms, which meant that the variance in latent stress on the measurement occasions was well (96-97 %) explained by the previous measurement. The Christmas holidays, however, upset the stability of the process to some extent: 68 % of the variance in latent stress during the first weekend measurement in January was explained by the autumn term stress. In spite of the stability of the covariance structure there were changes in the means and levels of latent stress. During the autumn term, the stress level increased and the weekend recovery from stress stopped towards the end of the term. During the spring term, however, the recovery continued from the beginning to the end of the term.

The results of these three articles (I, II, III) indicated that teacher stress had an identifiable cycle within the school year, the course of which was quite well predicted by the previous stress ratings. To some extent, the quality of the teacher's social relations at school and at home also had a predictive value in explaining, especially concurrent stress, but also stress over time. The possibility for annual recovery from stress was good during the spring term, whereas towards the end of the autumn term recovery stopped and stress accumulated. The effect of the Christmas holidays was clearly seen: the accumulation process was upset and the teachers could start the spring term without strong signs of accumulated stress.



**Figure 2.** Four profiles of stress process during the autumn term illustrated by anxiety.

## 5.2 Interindividual differences in stress and coping: stress process and coping profiles (IV)

In the fourth article (IV) teacher stress was examined in order to clarify whether stress, expressed by subjective mood ratings, manifests itself in various forms of process and to describe any observed interindividual differences between the possible process groups. The aim was to clarify specifically the role of coping in the stress process. That is why particular coping types were looked for in which styles of approaching problems varied. The examination was limited to the autumn term because both the recovery from as well as the accumulation of stress were shown to happen during that time.

According to the type of stress process, four different teacher groups emerged (Figure 2): (1) teachers who were exhausted throughout the autumn term ( $n=31$ ); (2) those who recovered from stress at the beginning of the term but not later on ( $n=53$ ); (3) teachers without any stress ( $n=46$ ); and (4) teachers feeling tired and anxious at the beginning and at the end of the term ( $n=23$ ). In Figure 2 the description is based on only the ratings of anxiety since these ratings offered the best reflection of the differences between the groups. However, other mood ratings followed the same time trend.

The four teacher groups differed in some background, personality and coping characteristics. In respect to the background variables, the most



**Table 4.** Differences in personality and coping variables between the four stress profile groups (the means of the scales and the levels of statistical significance obtained by oneway analysis of variance are presented).

Variable	1 n=31	2 n=53	3 n=46	4 n=23	F
Neuroticism	1.37	1.33	1.20	1.47	p<.001
Extraversion	1.44	1.39	1.37	1.51	p<.10
Internal control	3.78	3.88	3.99	3.82	n.s.
Type A behavior	3.10	3.15	2.98	3.12	n.s.
Emotion escape	2.32	2.39	2.02	2.40	p<.01
Depression/problem solving	2.70	2.44	2.20	2.78	p<.01
Social support	2.72	2.71	2.68	3.20	p<.05
Conscious suppression	1.88	2.15	2.24	2.28	p<.10

notable finding was that sex and group were related to each other ( $\chi^2=12.9$ ,  $p<.01$ ): "teachers without stress" (group 3) were more often male than female and "those feeling tired at the beginning and at the end of the term" (group 4) were more often female than male.

The main differences between the groups in personality and coping characteristics were as follows (see Table 4): Group 1 differed from other groups in conscious suppression: teachers in group 1 did not easily suppress difficulties. Group 2 was average in all regards and had no typical characteristics. Group 3 was the least neurotic of the groups. In addition, this group did not usually use escape as a way to cope with stress or become depressed when experiencing difficulties. It was typical of group 4 to seek social support in stress situations more often than the other groups.

According to the individual profiles of the coping variables, three clearly different teacher groups emerged: (1) the emotional teachers (n=42) who reacted at the affective and somatic level in stress situations, i.e. they became depressed and got e.g. a headache; (2) the rational teachers (n=49) were the opposite of the emotional teachers: they did not have any negative emotions or symptoms; and (3) the social teachers (n=45) used social support as the main strategy to cope in stress situations. Although the groups were named by only one coping strategy, in every group several strategies were used. For instance, coping strategies which strived for problem solving were common in every group.

As was expected these three coping groups differed from each other in sex and personality. From the association between sex and the coping group ( $\chi^2=17.2$ ,  $p<.001$ ) emerged the result that the social profile of coping was typical of female teachers and the rational profile of male teachers. However, in the emotional coping group both sexes were represented in the same relation as in the whole teacher group. The main personality differences between the groups were in neuroticism and locus of control. The emotional group was the most neurotic of the groups and had the weakest internal locus of control ( $p<.001$ ). The rational group, in turn, was the least neurotic, and had a stronger internal locus of control than the emotional group ( $p<.001$ ). The social group differed from the rational group in neuroticism: the social teachers had a higher neuroticism level than the rational teachers ( $p<.05$ ).

The groups of coping and stress process were related to each other significantly ( $\chi^2=17.6$ ,  $p<.01$ ). The emotional approach was the typical style of coping in group 1. Almost half (48 %) of the "teachers exhausted throughout the term" reacted very affectively in stress situations, and correspondingly, rational strategies were used the least (18.5 %). In group 2 all the three coping styles were used quite equally. Of "those without any stress" (group 3) about 56 % used a rational style of coping, and in turn, emotional coping was the least (18.6 %) typical style. In the U-shaped process group (4) either emotional or social strategies were in use.

The results reported in this article suggested that within the overall mean trend of teachers' stress in the course of an autumn term, at least four different stress processes and three coping profiles could be found, i.e. there were large interindividual differences in stress and coping among teachers. Furthermore, these stress and coping profiles were related to each other. The tendency seemed to be that the rational style of coping was typical of those having no stress, and the emotional ways of coping were typical of those having the most stress feelings. The outcome suggested that the most effective way to cope with stress was suppression and rationalization. However, the effectiveness of these strategies can be questioned in the long run.

### **5.3 Catecholamine excretion during night rest as a measure of accumulated stress (V)**

The present article (V) aimed at a further exploration of urinary excretion of adrenaline and noradrenaline during night sleep. Specifically, the possibility of using the indices of catecholamine excretion for the detection of emotional changes in the teacher stress process was examined. First, the relationships of emotional changes and excretion were studied cross-sectionally at different times of the term (i.e. at different situations), and,

secondly, intraindividually over the term. The present analysis was limited to the autumn term during which the greatest changes in subjective stress were perceived.

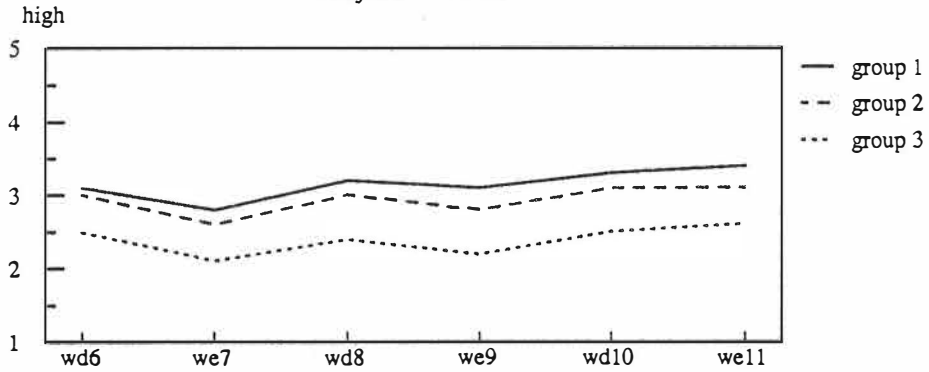
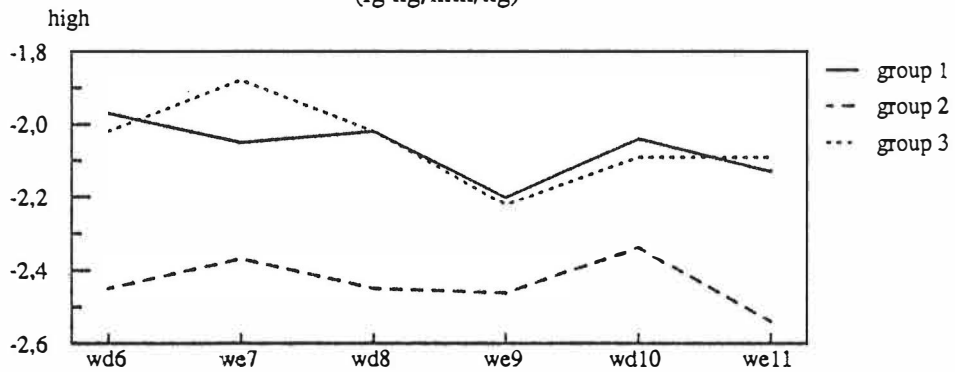
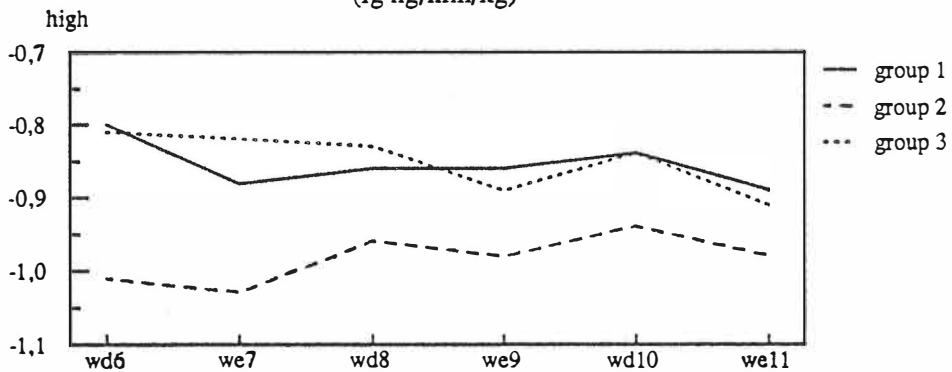
The correlations between urinary catecholamine excretion during night sleep and subjective mood states during the days preceding the research nights turned out to be weak and changed direction over the term. At the beginning of the term the association was negative: high adrenaline excretion was associated with low level of subjective stress ( $r=-0.18$ ,  $p<.05$ ), not feeling depressed ( $r=-0.22$ ,  $p<.01$ ) and sexual activity ( $r=-0.19$ ,  $p<.01$ ). Later, at the end of the term, the association was in the opposite direction: high adrenaline excretion was associated with feelings of stress ( $r=0.24$ ,  $p<.01$ ), anxiety ( $r=0.29$ ,  $p<.001$ ), depression ( $r=0.14$ ,  $p<.05$ ), strain ( $r=0.20$ ,  $p<.01$ ) and also with poor quality of sleep ( $r=0.16$ ,  $p<.05$ ).

Cluster analysis revealed three stable longitudinal profiles among the teachers, in which the stress indicators were related to each other in different ways (Figure 3). In the first profile ( $n=71$ ), a high overall level of subjective stress was associated with a high output level of catecholamines. The subjective stress process was reflected in the excretion as was expected, e.g. higher levels of excretion and subjective stress on workdays than weekends. The second process profile ( $n=37$ ) represented such cases in which the subjective stress was high and the catecholamine excretion low. The temporal form of noradrenaline excretion rate reflected very closely the form of the mood variable. Nonetheless, the adrenaline excretion rate showed a different time trend, especially at the beginning of the term. In the third process profile ( $n=29$ ), a low overall level of subjective stress was associated with high output of catecholamines. The forms of the catecholamine diagrams were — again especially at the beginning of the term — clearly different from the form of the diagram of the mood variable.

The findings were interpreted to reflect the changes in the intensity of emotional arousal during the term. As was found previously (articles I–III) the intensity of the arousal was highest at the beginning (positive arousal) and at the end of the autumn term (negative arousal). Thus, adrenaline response, which governs the magnitude of arousal rather than its quality, correlated first with positive and finally with negative arousal. In the cluster groups the subjective stress process was better reflected in noradrenaline excretion than in adrenaline excretion. The increasing subjective stress level over the term was not seen as an increasing excretion level as was expected on the basis of earlier studies.

In addition, concerning this problem area, variables possibly explaining the level differences between the three stress process groups were examined. The examined variables included characteristics of the teacher (sex,

## Subjective Stress

Adrenaline Excretion Rate  
(lg ng/min/kg)Noradrenaline Excretion Rate  
(lg ng/min/kg)

The Autumn Term of 1983, 16 August - 21 December

**Figure 3.** Three profile groups of stress during the autumn term (subjective stress feelings and catecholamine excretion during night sleep as stress indicators).

**Table 5.** Differences in age and personality variables between the three stress process groups (the means and the levels of significance obtained by oneway analysis of variance are presented).

Variable	1 n=71	2 n=37	3 n=29	F
Age in years	43.8	41.6	45.4	n.s.
Neuroticism	1.34	1.39	1.16	p<.001
Extraversion	1.41	1.47	1.33	p<.05
Internal control	3.83	3.89	3.94	n.s.
Type A behavior	3.05	3.18	2.94	n.s.
Emotion escape	2.38	2.39	1.87	p<.001
Depression/problem solving	2.57	2.58	2.14	p<.05
Social support	2.72	2.91	2.73	n.s.
Conscious suppression	2.08	2.20	2.25	n.s.

age, personality), some aspects of leisure time (use of stimulants, physical and social activities) and work (amount of work, quality of social interaction). The purpose was to test whether these variables, which have been shown to have effects on catecholamine excretion, also effect night-rest excretion. Table 5 gives the results of the differences between the groups in age and personality variables. The main difference was between groups 1-2 and 3. Group 3 differed from the other groups; it was the least neurotic and used escape the least as a way to cope. Sex and group were not related to each other.

Analyses of the differences in repeatedly measured variables revealed the main differences were between the high excretion groups 1 and 3. Teachers in group 1 rated their amount of work higher and correspondingly their amount of free time lower, than teachers in group 3. In group 1, the mean amount of professional work varied on workdays between 7.8 to 8.1 hours per day and in group 3 between 6.7 to 7.6 hours per day. Similarly in group 1, the quality of social interaction at home with family and at school with colleagues and pupils was rated worse than in group 3. The low excretion group 2 was situated between these two groups and did not differ in work amount and social interaction variables from the other groups. In addition, there were slight differences between the groups in the use of stimulants and in the time spent on physical activity. In these variables there were differences between groups 1 and 2. The low excretion group 2 consumed less coffee (3-4 cups/day) than the high excretion group 1 (4-5

cups/day) and spent more time (0.7-1.8 hours/day) on physical activities than group 1 (0.4-1.5 hours/day).

In all, on the examined variables there were not systematic differences between the groups in the direction expected. The variables seemed to explain differences rather between the high excretion groups (1 and 3) than between the high and the low excretion group (1 and 2) in which the subjective stress levels were quite similar. Thus, the differences in the excretion levels between the stress process groups were not as important as the subjective level of stress. The level differences in night-rest catecholamine excretion remained quite unexplainable.

The final conclusion of these results was that the night-rest catecholamine excretion worked as a measure of accumulated stress — at least to some extent. In the whole teacher group this was seen in the concurrent correlations between the self-reported psychological stress states and the adrenaline excretion rates at different points of the autumn term. At the subgroup level a teacher group was found in which the subjective stress process over the autumn term was reflected quite well in the excretion. In all, it seemed that catecholamine excretion during night rest, and especially adrenaline excretion, worked as an index of accumulated stress when the subjective stress level was high.

## 6 DISCUSSION AND CONCLUSIONS

### 6.1 Main findings

The present study showed that teacher stress had an identifiable cycle within the school year: An accumulation of stress happened during the autumn term with the result that weekend recovery disappeared in November-December. Specifically, in the last weekend measurement in December, the stress level turned out to be high. The Christmas, sports and Easter holidays seemed to prevent stress accumulation during the spring term. The annual course of the teacher stress process described above manifested itself in the form of illnesses, medicine intake, anxiety, depression, sexual passivity, and partly in catecholamine excretion during night rest.

The stability of the stress process was examined by assessing the predictability of the stress ratings throughout the school year within the framework of the LISREL models. The predictability of the stress process turned out to be high: over 95 % of the variance in latent stress in the measurements was explained by the previous measurement. In other words, the interindividual differences between the teachers remained similar during the terms. The effect of the Christmas holidays, about 10 days around Christmas, was noticed as it upset the stability of the stress process: 68 % of the variance in latent stress in the first weekend measurement in January was explained by the autumn term latent stress. The instability between the terms as well as the stress level comparisons indicated that the Christmas holidays were long enough to help the teachers to recover from autumn stress and start the spring term without strong signs of accumulated stress.

The annual cycle of teacher stress reflected teachers' work situation: the amount of work increased, especially on weekends, towards the end of both terms. Furthermore, the variation in the quality of social relations followed the same pattern; it was worse towards the end of the terms and better after the holidays. The analyses showed that the social relations at

school and at home proved more important than the amount of work in predicting concurrent as well as stress over time. It is possible that the two types of variables — stress feelings and social relations — both reflected the same process of stress accumulation during the autumn term as well as the effects, promotive of recovery, of the holidays. This may imply that as teaching, by its very nature is a continuous social interaction, it can produce strain and fatigue from which some teachers are unable to recover during ordinary weekends at the end of the autumn term.

The approaching Christmas could have influenced the stress ratings in the last weekend measurement in which the stress level proved exceptionally high. In direct support for the fact that teacher stress had significant origins outside the working life was the finding that home atmosphere had a significant effect on stress on every measurement occasion and a true predictive value, although small, in explaining stress from the beginning to the end of the autumn term. In other words, various temporal factors as well as factors concerning other areas of life besides work affect the process.

There is still one possible explanation for the form the stress process took: the idea of seasonality in the state of the human mind. Autumn is claimed to be the favorite season for experiencing moods of depression (i.e. here stress). However, the peak in suicides has been shown to occur in the spring and some studies point to a bimodal distribution of depression by season. For instance, Näyhä (1986) has shown that the spring peak in depressions is typical of the middle classes and farmers and the accumulation of depression later in the year is typical of occupations at both ends of the social scale and outside agriculture. This means that the annual course of stress is perhaps also typical of other occupations.

The high stability of the stress pattern suggests that behind this phenomenon are some not yet examined "third variables", e.g. personality traits or stable living conditions. For instance, a tendency to view the self, others and the world in negative terms (Watson & Clark, 1984) may produce the high predictability. The results concerning the stress process and coping types and their relationships also support personality explanations.

These results indicated the internal consistency of the respondents' questionnaire data. Those experiencing stress feelings the most (group 1) also had ineffective ways of coping, and their personality included disadvantageous features to stress, neuroticism and external locus of control. On the contrary, those without any stress (group 3) had effective ways of coping, and they were internally controlled and not neurotic by personality. According to Cox (1985), this internal consistency of the subjective data provides some test of their validity. On one hand, a common method variance can contribute to the findings, and on the other,



these responses of stress and coping may be indicative of the underlying personality disposition, negative affectivity. It is quite obvious, at least, that the teachers' coping strategies played a role already at the moment the questionnaire responses were given.

Further evidence for the subjective assessments of stress was looked for in the data on night-rest catecholamine excretion. The change of the teachers' psychological state from positive to negative during the autumn term was also seen in the correlations between the feelings of stress and the excretion. At the beginning of the term the adrenaline excretion rate correlated with positive arousal (joyful effort, sexual activity) and at the end of the term with negative arousal (anxiousness, depression, strain, sexual passivity). However, although statistically significant the associations were low.

In addition, there was a group of teachers in which the subjective stress process over the term was reflected quite well in the catecholamine excretion. On the other hand, there were also two groups in which subjective stress did not have a close correspondence with excretion. The increasing stress process was not seen as an increasing excretion process; on the contrary, there was a slight decreasing tendency in the excretion level towards the end of the term. It could be that at the end of the term the teachers perceived themselves as being less in control of the situation, and they "gave up", and that cortisol measures, if they had been collected, would have been higher at the end of the term, although adrenaline measures were not (Frankenhaeuser, 1986).

Longitudinal studies as intensive as this one have not been conducted elsewhere. This makes it difficult to compare the results with previous findings. In Fleischut's (1985) study, which consisted of five measurements, the actual stress levels among elementary school teachers increased and decreased in the same way as they did in this study. In other studies (Brenner et al., 1985; DePaepe et al., 1985; Wade et al., 1986; Rajala, 1988) there were two or three measurements during the school term or year, and the experienced stress did not fluctuate clearly. The results concerning the predictors of stress confirmed earlier findings: the subjective correlatives had more predictive power than the objective correlatives, and the contribution of outside work related factors was notable. The latter outcome was consistent with Kalimo's (1985) observation that the contribution of work-related factors usually accounted for less than 30 % of the total variance of psychological and unspecific somatic syndromes in Finnish working populations.

Such models of teacher stress where the aim is to check how well the structure of the empirical correlations between the variables corresponds to the hypothetical model chosen have been empirically tested since the early 1980's (e.g. Brenner et al., 1981; Mäkinen, 1982; Tellenback, 1982;

Tellenback et al., 1983; Brenner & Bartell, 1984; Brenner et al., 1985). However, these models are mainly based on cross-sectional data whereas here the main interest was to estimate and test a longitudinal model. An attempt was also made to incorporate the cross-sectional regression models into the longitudinal quasi-simplex model, but this was rejected because the model showed a statistically significant lack of fit. On the basis of the strong simplex connections between the latent stress variables and the low percentage of variance explained by the regression models, the conclusion was partly expected.

## 6.2 Methodological evaluation

The present study was based on data from questionnaires and laboratory measurements. Although a questionnaire survey is a widely applied method for gathering data in stress research, it has certain limitations as discussed earlier. However, stress itself is a complex individual psychological process. It deals with the person's perception of the (work) environment and the (emotional) experience of it. This means using subjective data. Naturally, the methods used to collect such data should be shown to be reliable, valid and fair.

In questionnaires, when single items are used instead of sum scales as indicators of concepts, the reliability of the indicators can be expected to vary a great deal. Estimating the reliability of the individual questions is also problematic in questionnaire studies because parallel questions are often missing in the questionnaires. The main result of this problem is that the statistical estimates of the relationships among variables remain rather low, and the variables cannot be corrected for the effects of the reliabilities. In this study the underestimation was quite clearly demonstrated by comparing the perceived correlations of stress variables between the measurements with the relationships produced by the LISREL model solution which takes measurement errors into account. Also, the low reliabilities of the coping scales could result in the rather low correlations between these variables and, for instance, stress variables.

Laboratory measurements were used as another method of gathering stress data. The use of physiological indicators as measures of stress is neither as convenient nor as straightforward as self-report data to gather and interpret. Because the present study was a field study, i.e. the study was not conducted under controlled conditions in the laboratory, possible sources of errors exist. First, the teachers themselves were responsible for gathering the whole night urine samples. Although the instructions on how to do this were stressed, it is possible that they were not carefully followed. Second, in differential fluorometry the very low urine concentration of adrenaline during night rest increases its variance

methodologically. This fact, although the intercorrelation of adrenaline in duplicate measurements was rather high (0.91), may have also produced confusion.

The nature of the valid relationship between psychological stress and catecholamine excretion was theoretically based: urinary catecholamines are considered appropriate for measuring long-lasting job stress (see Fried et al., 1984; Ward & Mefford, 1985; Steptoe, 1986). The results of the hormonal measurements supported the view that night-time catecholamine excretion was a useful measure (correlate) of teacher stress when the stress level among teachers was high, i.e. at the end of the term or in a group with high stress. However, the level differences in the night-rest catecholamine excretion were not well explained by the variables concerning the teachers' background, leisure time and work. This refers to the possibility that some other not examined variables ought to be considered. For instance, features of sleep could be worth studying more thoroughly in sleep laboratory conditions when night-rest excretion is in question.

The longitudinal nature of this study was its advantage: the cycle of teacher stress over the school year was revealed. However, new information on the causal connections in the stress-illness relationship was not gained. A longer research period would be needed in order to find out how stress contributes to ill health. Although it is known that stress may lead to illness at least through the development of health-threatening behaviors or sustained activated neuro-endocrine responses, the outcomes of these mechanisms could not be seen because the time frame was not long enough.

Longitudinal studies have problems, for instance, concerning the experimental mortality and the test-retest effect (Nesselrode & Baltes, 1979). There were problems in sample maintenance also in this study. However, systematic differences were not found at least in the background variables between those who were absent from the study on some measurement occasions and those who participated regularly. The test-retest effect was not controlled. Controlling would have been possible if there had been groups of teachers each of which had participated in the study only on one measurement occasion. Therefore, the ways in which the continuous participation influenced the stress ratings can only be presumed.

The statistical analyses were mainly conducted with the application of the LISREL models and cluster analysis. The LISREL models proved to be efficient in analysing the structural features of the stress process. By using the quasi-simplex models and their modifications the following advantages were achieved: firstly, all the stress data were analysed simultaneously in a statistically efficient way. Secondly, the covariance and the mean structure of the latent stress process was also examined over the school year, and thirdly, the existence of the autumn and spring

term stress factors, their dependence and level difference were statistically tested. When analysing the influence of the potential stressors on teacher stress the LISREL approach was quite similar to a traditional regression model because only one construct was assessed by multiple measures and revealed measurement errors.

Cluster analysis was used to solve such classification problems in which little was known about the category structure in the data. In particular, applications in the longitudinal data were conducted which were unusual, at least when compared to the examples of the applications represented in the clustan user manual. The results of the cluster analyses were interpretable on the basis of the theoretical framework. Although cluster analysis is an exploratory method, it cannot be assumed that another more sophisticated method would have provided essentially different information.

### **6.3 Solutions for the prevention of teacher stress on the basis of this study**

A majority of the teachers reported psychological stress symptoms and a small number of them did not feel stressed at all. However, the study did not reveal how many of the teachers lived with psychosomatically harmful stress because the stress indicators in use were mainly subjective emotional experiences. On the other hand, it can be asked whether the answer to this question concerning the stress-illness link would be better reached even by other stress indicators. In addition, the fact that the volunteer sample of teachers participating in this study was probably selective makes it difficult to give an accurate description of the level of well-being among teachers in general. One is also tempted to question whether people should really strive for work and life without any stress.

The subjects of the study felt especially stressed at the end of the autumn term. The same phenomenon, an accumulation of stress towards the end of the term, did not seem to happen during the spring term. This can be due to the fact that there were better possibilities (more breaks) to recover from stress during the spring term than during the autumn term. This result could also be due to the selection of the research days. If the last measurement occasion in the spring had been later in May, stress accumulation could perhaps have emerged. However, at least at the end of the autumn term there were teachers who were unable to recover from stress during ordinary weekends. This alternative is a more serious one because there are more days of the school year left after November-December than after May.

According to the results of this study, one practical way of ensuring adequate recovery would be the insertion of a new longer break into the

middle of the autumn term. The present term without any break seemed to cause accumulation of stress in a notable proportion of teachers. Of course, all teachers do not need such a break but in practice there are no individual alternatives to carry out this arrangement. This organizational solution would be one way to prevent harmful stress which now, at least among some teachers, continues over Christmas to the spring term.

Another recommendation based on the results concerning the effects of poor teacher-pupil relations is to further develop supervision for teachers. This form of activity has increased among teachers, and has proved successful in dealing with problems and worries concerning different aspects of teacher work (Ojanen, 1985, 1987).

Furthermore, special attention could be paid to ways of coping among teachers. However, aim to get more effective individual strategies in coping with stress at work, ought to be secondary because the primary aim, to prevent stress, involves qualitative improvements in the working conditions. As Cox et al. (1988) state, an organizational view of the issue of stress in schools is needed instead of the perspective of the individual teacher. Therefore, organizational and managerial strategies for dealing with stress problems are also important.

The results concerning coping effectiveness in reducing stress among teachers were not unambiguous: for instance, strategies striving for problem-solving do not ensure successful outcomes; in contradistinction, teachers who used problem-solving strategies turned out to only gain more stress (Rajala, 1988). This finding is not consistent with most theories which seem to agree that problem-focussed coping has positive consequences. However, Frese (1986) claims that if coping strategies are checked off on a questionnaire (as was the case in Rajala's study), only consciously used strategies will be checked. This is based on the claim that only when normal, easy to use, automatic coping strategies do not work do we think of them consciously. This means that problematic coping strategies will be reported more often than nonproblematic (i.e. automatically used) ones. Therefore, according to Frese, coping strategies measured with questionnaires lead to positive relations with psychological dysfunctioning.

However, in the present study problem-solving was typical particularly of those teachers who were not stressed, although problem-solving strategies were used by all the teachers to some extent. Pöyhönen (1987) also found successful coping strategies with work stress in her study of mental hospital personnel: in this case job stress was appraised as a challenge and coped with through active problem solving. In both of these studies coping was measured with questionnaires. To sum up, it is thought that effective ways of coping can be learned, and that stress-reducing programs are on the increase, even in Finland. For instance, in the journal

of Opettaja (Teacher) announcements of such programs have increased.

The research program on teacher stress continued in the autumn of 1988. Namely, the boards of school in Jyväskylä and in the neighbouring municipalities decided to carry out an autumn holidays experiment which offered a possibility to study the effects of an autumn break on the teacher stress process and to test in practice the effects of the holidays recommendation made in this study. With this experiment the answer to the question of how to rhythm the annual school work will become even more accurate. Besides gaining information on the effects of this organizational solution through the study, information on the effects of the individual coping efforts on the teacher stress process will be improved. The purpose is to explore changes in the coping strategies over time for it is obvious that as the stress process proceeds the coping strategies also change. In addition, more accurate data concerning recovery during the holidays will be gained. The question of which aspects of the holidays, i.e. which freetime activities, are refreshing will be answered, and it will be especially interesting to study the interindividual differences in this regard. Finally, this experiment will give follow-up information about stress among 57 teachers (at best) who participated in this study and will also participate in the autumn holidays experiment.

## TIIVISTELMÄ: OPETTAJAN TYÖSTRESSI LUKUVUODEN AIKANA

Tutkimuksen päätavoitteena oli (1) tutkia opettajan työstressin etenemistä lukuvuoden aikana kuormittumis- ja elpymisprosessina, (2) selvittää stressin kokemisessa ja sen käsittelyssä ilmeneviä yksilöllisiä eroja ja (3) tutkia koetun stressin ja yölevon aikaisen katekoliaamiinierityksen välisiä yhteyksiä. Tutkimus on raportoitu viitenä erillisenä artikkelina ja käsillä oleva kokonaisuus muodostuu yhteenvedosta, joka sisältää artikkeleiden yhteisen teoriaosuuden ja metodien kuvauksen, tulosten tiivistelmäosan sekä tutkimuksen yleisen arviointi- ja johtopäätösosan.

Tutkimuksen teoreettisena lähtökohtana oli stressin ymmärtäminen yksilön ja hänen ympäristönsä vuorovaikutuksesta syntyvänä prosessina. Näin stressikäsite kattaa ympäristön yksilölle asettamat vaatimukset (mahdollisuudet, rajoitukset) ja yksilön vaatimuksiin vastaamisresurssit, vuorovaikutusta arvioivat kognitiiviset prosessit, stressaavan vuorovaikutuksen käsittelykeinot sekä stressiin reagoimista kuvaavat psyykkiset, psykosomaattiset sekä käyttäytymisen tasolla ilmenevät reaktiot. Lisäksi painotettiin ensinnäkin sitä, että stressi on aikaan sijoittuva prosessi, so. kuormittumis- ja elpymisprosessi, jossa stressin voimakkuutta voidaan mitata elpymisen funktiona. Tällaisena prosessina stressi on tyydyttävästi tutkittavissa vain tekemällä seuranta tutkimusta riittävän pitkällä aikavälillä ja tutkimalla työn erilaisia kuormitusvaiheita sekä oletettuja elpymiskausia. Toiseksi pidettiin tärkeänä useampitasoista — psykososiaalista ja biologista — stressiprosessin analyysia.

Tutkimuksen perusjoukkona olivat viiden kunnan peruskoulun ja lukion opettajat ( $N=1875$ ). Heistä poimittiin 564 opettajan otos ositettuna kunnan, kouluasteen ja sukupuolen mukaan. Kaikkiaan 187 opettajaa (33 %) suostui mukaan tutkimukseen. Katoa koskeneet analyysit osoittivat, että tutkimukseen osallistuneet olivat jossain määrin valikoituneet (esimerkiksi naiset ja keski-ikäiset opettajat olivat suostuneet muita halukkaammin mukaan tutkimukseen) ja näin tutkitut eivät muodosta edustavaa otosta perusjoukosta. Kuitenkin menettelyllä saavutettiin tavoitteena ollut merkityksellisiksi katsottujen osaryhmien riittävä edustus tutkimuksessa.

Opettajia seurattiin lukuvuoden 1983–1984 ajan toistetuin kyselyin se-

kä laboratoriomittauksin. Kaikkiaan suoritettiin 17 mittausta huhtikuun 1983 ja toukokuun 1984 välisenä aikana. Osa mittauksista koski viikonloppuja tai loma-aikaa ja osa työviikkoja. Pysyväisluonteisia taustatietoja ja opettajan persoonallisuutta koskeva aineisto kerättiin ns. taustakyselyinä syksyllä 1983. Laboratoriomittauksissa määriteltiin katekoliaamiinien (adrenaliini ja noradrenaliini) erityspitoisuuksia ja -nopeuksia yölevon aikana erittyneestä virtsasta.

Tulokset osoittivat, että opettajan stressiprosessissa oli selvä syklinen vaihtelu lukuvuoden aikana. Opetustyössä syyslukukausi koettiin kuormittavampana kuin kevätlukukausi. Tämä ei kuitenkaan näkynyt työpäivinä tehdyissä mittauksissa, vaan ainoastaan viikonloppumittauksissa siten, että kevätlukukaudella viikonloppuelpymistä tapahtui koko lukukauden ajan, kun taas syksyllä se jäi tapahtumatta lukukauden puolivälistä lähtien; ts. syyslukukaudella kuormittuminen oli kasautuvaa. Kuvatunlainen kehitys oli nähtävissä sekä subjektiivisessa ahdistuneisuuden, masentuneisuuden ja kiireisyyden kokemisessa että lääkkeiden käytössä ja sairastelussa, samoin kodin ja koulun ihmissuhdearviot heijastelivat samaa suuntausta.

Stressiprosessin kulku lukukausien aikana oli hyvin ennustettavissa aina edellisen mittauksen perusteella. Opettajan stressiprosessi oli varsin stabiili lukukausina, mutta joululoma katkaisi stabiiliuden ja tammikuun alussa koettu stressi oli huonoiten ennustettavissa. Tämä merkitsee sitä, että yksilöiden väliset erot stressin kokemisessa pysyivät samoina lukukausien ajan ja että joululomalla tapahtui huomattavaa elpymistä syyslukukauden aikaisesta stressistä. Jossain määrin myös koulun ja kodin ihmissuhdearviot ennustivat, etenkin samanaikaista, mutta myös pitemmän aikavälin stressiä. Sen sijaan työn kuormittavuus työmääränä mitattuna ei osoittautunut stressiprosessia ennustavaksi tekijäksi.

Stressin kokemisessa havaittiin yksilöllistä vaihtelua. Itse asiassa tutkittaessa syyslukukauden aikaista stressiprosessia tarkemmin löydettiin opettajien keskuudesta neljä erilaista prosessityyppiä: (1) tasaiset uupujat, (2) alkuelpyjät, (3) hyvävoimaiset ja (4) alku- ja loppu-uupujat. Samoin opettajien coping-strategiat olivat erilaisia. Havaittavissa oli kolme erilaista coping-profilia: (1) emotionaalinen, (2) rationaalinen ja (3) sosiaalinen. Stressin kokemista ja sen käsittelyä kuvaavat tyypit olivat yhteydessä toisiinsa siten, että emotionaalinen stressin käsittely oli tyypillistä tasaisille uupujille, alkuelpyjät käyttivät kaikkia kolmea stressin käsittelyn strategiatyyppiä, hyvävoimaiset olivat stressin käsittelyltään enimmäkseen rationaalisia ja alku- ja loppu-uupujat joko emotionaalisia tai sosiaalisia. Lisäksi sekä stressin kokemisen että stressin käsittelyn ryhmät erosivat toisistaan taustatekijöiltään, mm. sukupuoleltaan ja opettajakokemukseltaan, ja persoonallisuudeltaan.

Yölevon aikaisen katekoliaamiinierityksen korrelaatiot koettuun stressiin



olivat heikkoja, joskin tilastollisesti merkitseviä. Havaittavissa oli lisäksi korrelaatioiden suunnan muutos syyslukukauden aikana; ts. syyslukukauden alussa korkea erityis korreloi positiivisesti vireyden ja tarmokkuuden tuntemuksiin ja lopussa lamaantumisen ja uupumuksen tuntemuksiin. Ryhmittelyanalyysin perusteella opettajia kuvaamaan löytyi kolme prosessityyppiä. Parhaiten subjektiivinen stressiprosessi heijastui erityiseen ryhmässä, jossa sekä koettu stressi että erityis oli tasoltaan korkea. Näytti siis siltä, että yölevon aikainen katekoliamiinieritys, ja erityisesti adrenaliinieritys, toimi stressin indikaattorina silloin, kun stressiä koettiin todella olevan; ts. kuormittuneimmassa osaryhmässä sekä syyslukukauden lopussa koko opettajaryhmässä.

Tutkimus paljasti, että opettajat olivat erityisen kuormittuneita syyslukukauden lopussa. Ilmiön taustalla lienee se tosiasia, että jatkuva ihmissuhdetyö sinänsä tuottaa ainakin osassa ihmisiä kuormittuneisuutta, josta elpymiseen tavalliset viikonloput eivät riitä. Vastaavaa kuormittumisen kasautumista ei ollut havaittavissa kevätlukukauden loppua kohti ilmeisesti kevätlukukauden parempien elpymismahdollisuuksien (useampien lomien) vuoksi. Näin ollen tutkimuksen pohjalta päädyttiin esittämään kuormittumisongelman yhdeksi käytännön ratkaisuksi yhtenäisen syyslukukauden katkaisevaa lomaa lukukauden puoliväliin.

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## APPENDIX I

### Research variables and scales

The list of research variables and constructed sum scales are given in this appendix. Only those variables used in the present report and in the original publications (articles I-V) are presented. Those variables which are based on the background questionnaire are marked by BQ and those based on the repeated questionnaires by RQ. The variables which are based on personnel records data are marked by R and the ones based on laboratory measurements by L. Estimates of reliability are given for the variables for which the calculation of reliability was possible either on the basis of the sum scale or the factor structure. Those sum scales which are not based on previously known applied measures are described more thoroughly than others.

#### I Personal and occupational background

These variables are one-item measures.

- R Sex
- R Age in years
- R School level
- R Community size
- BQ Teaching experience in years
- BQ The state of health

#### II Personality

These variables are sum scales which have been transformed back to the original scale by dividing by the number of items in each summated scale. The direction of the scales is towards increasing magnitude of concept.

- BQ Neuroticism, range 1-2, (10 items, rel=0.78)
- BQ Extraversion, range 1-2, (20 items, rel=0.79)
- BQ Locus of control, range 1-5, (8 items, rel=0.66)
- BQ Type A behavior, range 1-5, (18 items, rel=0.71)

### III Coping

These variables are sum scales based on a factor analysis. The variables have been transformed back to the original scale by dividing by the number of items in each summated scale.

The factors were extracted by principal axis technique and the rotation was conducted by the varimax method.

The instruction: Please indicate on a 5-point (1=not at all, 5=to a great deal) Likert scale the extent to which the items below describe your way of handling problem situations.

#### BQ **Emotion escape** (factor I, 8 items, $rel=0.62$ )

Eigen value 2.97, Variance explained 11.4 %

	loading
I use alcohol more than usual	.47
I blame myself for problems	.46
I use a tranquilizer	.45
I become paralyzed	.44
I get ill, e.g. a headache	.42
I eat all the time	.40
I spend my time on watching TV	.38
I can't sleep, I am awake at night thinking about the problem	.33

#### BQ **Depression-problem solving** (factor II, 5 items, $rel=0.66$ )

Eigen value 2.07, Variance explained 8.0 %

	loading
I get depressed and feel powerless	.59
I cry	.49
I try to solve the problems	-.42
I try to look for the bright side of things	-.49
I work with the problems more persistently than before	-.64

#### BQ **Social support** (factor III, 5 items, $rel=0.65$ )

Eigen value 1.59, Variance explained 6.1 %

	loading
I ask for help from somebody	.64
I discuss the problems with my friends or my family	.57
I go out to meet my friends	.55
I go on a trip	.32
I want to be alone with myself	-.44

**BQ Conscious suppression (factor IV, 4 items,  $rel=0.61$ )**

Eigen value 0.98, Variance explained 3.8 %

	loading
I push the problem out of my mind by thinking about other things	.63
I believe problems will become clear without doing anything	.50
I start to work on something else	.39
I go jogging	.35
I think about the matter, my mind is occupied by the same thoughts	-.43

The following items the loadings of which were under .30 were not included in the scales:

I get angry at people

I think that many people are worse off than me

I smoke more than usual

**IV Co-factors of stress****RQ Time budget variables (hours/day)**

These variables are based on workdays on the means of Monday through Thursday, and on weekends on the means of Saturday and Sunday.

Classroom hours

Work outside classroom

Total amount of professional work

Totally free time for personal use

Amount of night time rest

Amount of physical free time activities

Amount of social free time activities

**RQ Social relations variables**

These variables are one-item measures.

The ratings of relationships at school concern school weeks, and the ratings of home relations are given concerning either school weeks or weekends.

Pupil motivation

Pupil conduct

Colleague relations

Home relations

**V Indicators of stress****RQ Mood variables**

These variables are sum scales, which have been transformed back to the original scale by dividing by the number of items in each summated

scale.

The instruction: Please indicate your mood and condition on work-days or weekends by the following adjectives. Five means strongly anxious, cool etc., three is a neutral choice and one means strongly calm, irritable etc.

**Anxiety** (2 items, rel=0.79)

calm	1	2	3	4	5	anxious
irritable	1	2	3	4	5	cool (item is reversed)

**Depression** (3 items, rel=0.81)

depressed	1	2	3	4	5	energetic (item is reversed)
vigorous	1	2	3	4	5	helpless
exhausted	1	2	3	4	5	powerful (item is reversed)

**Strain** (2 items, rel=0.59)

unhurried	1	2	3	4	5	hurried
distressed	1	2	3	4	5	untroubled (item is reversed)

**Sexual passivity** (1 item)

sexually active	1	2	3	4	5	sexually passive
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**A sum score of stress feelings** (6 items, rel=0.81-0.88)

Computed by summing the ratings of six mood variables: anxiety, irritability, depression, helplessness, exhaustion, distress.

The score has not been transformed back to the original scale.

**RQ Health complaints**

A dichotomously recoded variable none/one-or-more.

**RQ Medicine intake**

A dichotomously recoded variable none/one-or-more.

**L Physiological measurements**

Adrenaline concentration in urine ng/ml

Noradrenaline concentration in urine ng/ml

Adrenaline excretion rate in urine ng/min/kg

Noradrenaline excretion rate in urine ng/min/kg

Variables used mainly as controls for physiological measurements:

**RQ Smoking** (cigarettes/day)

**RQ Alcohol consumption** (alcohol quantity on a scale from 0 to 4/day)

**RQ Coffee consumption** (cups/day)

**RQ Quality of sleep** on research nights