Received 23 June 2008
Revised 18 September 2008
Accepted 22 September 2008

Non-linear modeling of growth prerequisites in a Finnish polytechnic institution of higher education

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Abstract

Purpose – This study aims to examine the factors of growth-oriented atmosphere in a Finnish polytechnic institution of higher education with categorical exploratory factor analysis, multidimensional scaling and Bayesian unsupervised model-based visualization.

Design/methodology/approach – This study was designed to examine employee perceptions of how their managers create conditions that support professional growth and learning, and how the employees perceive their growth motivation and commitment to the organization. Data were gathered from 447 employees with the Growth-oriented Atmosphere Questionnaire in a Finnish polytechnic institution of higher education.

Findings – Results showed that the theoretical four-group classification of the growth-oriented atmosphere factors was supported by the empirical evidence. Results further showed that managers and teachers had higher growth motivation and level of commitment to work than other personnel, including job titles such as cleaner, caretaker, accountant and computer support. Employees across all job titles in the organization, who have temporary or part-time contracts, had higher self-reported growth motivation and commitment to work and organization than their established colleagues.

Practical implications – Leaders in various organizations may benefit from learning what is the current professional growth status of diverse employee groups, and in understanding the potential differences in employee growth motivation.

Originality/value – This study contributes to an understanding of organizational growth and learning as a non-linear process. The statistical non-linear modeling approach is novel providing research and practical example of how to use these techniques in practice.

Keywords Organizations, Continuing development, Workplace training, Modeling, Polytechnics, Finland

Paper type Research paper

Introduction

Professional growth is a continuous learning process that enables individuals to acquire the knowledge, skills and abilities needed to cope with changing demands for vocational proficiency throughout their career (London and Mone, 1999). It is, thus, viable to speak about "professional career growth" to distinguish it from the concept of "professional development", which is a collection of concrete developmental strategies and functions that aim to support professional growth. However, these two concepts appear in the research literature intertwined in the form of "professional growth and development". This is natural, as the professional development is *de rigueur* but not *de facto* for professional growth (Nokelainen, 2008).

Journal of Workplace Learning
Vol. 21 No. 1, 2009
pp. 36-57

1366-5626
DOI 10.1108/13665620910924907

London and Mone's term "continuous" describes strong and durable need or will to learn and also valuation of learning. "Learning" refers in this context individuals will to develop one's skills via practice and training in order to meet changing challenges of the work. Naturally, in most cases such development is possible only if employer/organization shares the same goals. Continuous learning is characteristic of multifaceted career that is in fact defined as growth of know-how (Ruohotie, 2000). People may have at the same time several career paths or consecutive work periods in different companies or even in different professions.

In order to be successful, educational organizations must provide effective professional development programs for employees over the entire course of their careers (Lawler, 1994). This notion makes studies of professional updating, and especially those concerning the problems and prerequisites of continual growth in various work communities, most important. These include factors within the individual, the job, the work place and society (Nokelainen, 2008; Ruohotie, 1996; Ruohotie and Nokelainen, 2000).

Continuous development and updating of skills is important, otherwise they may become useless (or at least obsolete) for the work life. Kaufman (1974, p. 23) has defined the professional obsolescence as "the degree to which professionals lack the up-to-date knowledge and skills necessary to maintain effective performance in either their current or future work role." According to Pazy (2004), professional updating is a learning response to imminent obsolescence. Like other forms of adult learning beyond formal education, updating is characterized by a problem focus (Knowles, 1990), and it is typically a self-initiated, self-structured, and self-defined activity. This paper has two main goals. First, to present a theoretical model of growth-oriented atmosphere and, second, to demonstrate its practical use as a measurement instrument of growth prerequisites with different employee groups of a Finnish polytechnic institution of higher education.

Growth prerequisites are examined on the basis of a 14 dimensional theoretical model of growth-oriented atmosphere developed by Ruohotie and Nokelainen (2000). The organization investigated in this study received its polytechnic institution of higher education status among the first in 1996. We conducted the first survey investigating growth prerequisites in the organization in 1998 (Ruohotie and Nokelainen, 2000). This research paper reports the findings of the second survey that was conducted in 2002. Although the study reported here is based on non-probability sampling, the polytechnic institution of higher education investigated in this study represents all the other 30 organizations quite well as they all had to meet the same criteria (e.g., planning, function and goals of education, curriculum, the development of evaluation and feedback systems) evaluated by the same committee before they were promoted from vocational institutions to high schools.

The Finnish education system consists of comprehensive school, post-comprehensive general and vocational education, higher education and adult education. Comprehensive school provides a nine-year compulsory educational program for all school-age children, beginning at the age of seven. Post-comprehensive education is given by upper secondary schools and vocational schools or institutes. The higher education system consists of 20 universities and 31 polytechnic institution of higher education. The higher education system as a whole offers openings for 66 per cent of the relevant age group (universities: 29 percent, polytechnic institutions of

higher education: 37 percent). Polytechnic institutions of higher education have been part of the Finnish school system now for only ten years. The polytechnic institution of higher education evaluation committee decided between 1992 and 1996, on the basis of the 14 evaluation criteria, which of 200 vocational education institutions were promoted to polytechnic institutions of higher education (Liljander, 2002, p. 10).

The following four research questions are to be considered:

RQ1. Is the 13-factor model of the growth-oriented atmosphere relevant to describe growth prerequisites of Finnish polytechnic institution of higher education employees?

RQ2. Is the theoretical four-group classification of the growth-oriented atmosphere factors present in the sample?

RQ3. To what extent employees' position is connected to growth motivation and commitment to the organization?

RQ4. Is employee's nature of contract connected to growth motivation and commitment to the organization?

The data analyses applied in this study are exploratory factor analysis for categorical indicators (*RQ1*), multidimensional scaling (*RQ2*) and Bayesian unsupervised model-based visualization (*RQ3* and *RQ4*).

The paper is organized as follows: first, we give a condensed up-to-date introduction to the theoretical model of growth-oriented atmosphere. Second, we represent the empirical results considering the four research questions.

Growth prerequisites in organizations

Professional development includes all developmental functions, which are directed at the maintenance and enhancement of professional competency. In the modern world, updating is, ideally, a continual, lifelong process that addresses such goals as the acquisition of new and up-to-date information, the development of skills and techniques and the elevation of one's personal esteem (Ruohotie, 1996). The maintenance and enhancement of competency is subject to the combined effect of many factors, ranging from personal traits to salient features of the work environment (Fishbein and Stasson, 1990).

Maurer and Tarulli (1994) have identified the following factors affecting the voluntary involvement of workers in development activities:

(1) Perceptions related to the working environment.

(2) Perceptions and beliefs regarding the benefits of development.

(3) Values and judgments.

(4) Personality factors including:

- identification with work;
- the personal concept of career;
- the need for self-development; and
- self-efficacy.

Hall (1986) has created a model of mid-career sub-identity development which outlines factors that influence professional development (growth triggering factors) and the process through which the professional exploration cycle progresses. It shows that professional growth is dependent on the social and institutional context as well personal attributes and circumstances. Several factors are presented which can trigger in career routine and lead to the acquisition and development of new knowledge and skills.

Organizational triggers

Changes in organizational structure, areas of responsibility and tasks often require the development of new skills. Individuals respond to such changes both effectively and behaviorally according to their perception of their circumstances, interpreting environmental events or situational change on the basis of personal values and perspectives.

Research conducted as part of the Growth Needs Project in Finland show that the following factors are among the keys to the creation and maintenance of growth and high innovative capacity in an organization (Ruohotie, 1996):

- *Creation of a supportive culture.* In a supportive environment innovation becomes a natural part of everyday work. Tasks may be intentionally defined in broad terms, encouraging change and emphasizing the possibility of choice.
- *Reward of development.* In innovative organizations learning, initiative and experiment are prized as inherently valuable.
- *Supportive and participative management.* In innovative organizations it is seen as the duty of management to create a workplace where each individual can reach his/her or her full potential.
- *Intensive communication.* The more intensive the communication, the more effectively new ideas and alternative points of view can be shared and developed.
- *Security:.* In an era of intensifying competition, the organizations that will survive and succeed are those where there is a secure and confident atmosphere for employees. The fear of failure, of blame or of criticism is an effective damper to creative innovation.

Generating continuous enlivening innovation requires at least two things of an organization:

(1) it must learn to fully develop and utilize the capacity of its personnel; and

(2) it must show imagination at all times, suspending judgment temporarily when necessary in order to promote the development of new ideas.

Work role triggers

Research results of the Growth Needs Project indicate that motivational aspects of the work environment and the individual's opportunities to influence it correlate positively with personnel motivation. Boring, repetitive and dependent work discourages professional development and growth. Challenging, variable and independent work encourages it (Ruohotie, 1996).

Personal triggers

Events or stages connected to everything from personal factors to life changes – for example, changes in family relationships, health, age and so forth – can cause an individual to reconsider his or her career priorities and goals. In addition, according to Hall (1986, 1990), certain personal characteristics predispose an individual to make changes in order to avoid the negative consequences of work pressure or deal with personal frustration at the status quo (i.e. basic personality disposition, motivation for advancement, initiative, stress on performance, hardiness, flexibility, tolerance of ambiguity, independence).

Factors contributing to growth-oriented atmosphere

Important factors in the development of growth orientation are support and rewards from the management, the incentive value of the job itself, the operational capacity of the team and work-related stress. Each of these can further be divided into smaller individual factors.

Management and leaders face such challenges as how to empower people, support the development of their professional identity and how to create careers based on interaction. They should also aim to develop, reward, set goals and evaluate learning in the organization. Successful leadership creates commitment to the job and the organization.

The incentive value of the job depends on the opportunities it offers for learning, i.e. the developing nature of the job. Therefore, essential factors for professional growth are the developmental challenges, the employees' chances to influence, opportunities for the collaborative learning and valuation of the job.

The operational capacity of a team or a group can be defined by its members' capability to operate and learn together, by the work group co-operation and by the reputation for effectiveness.

Work-related stress might become an obstacle to professional growth. Ambiguity, vagueness and role conflicts, a too heavy mental load and demand for continual alterations may stress people and damage the organizational atmosphere. Negative stress quickly suppresses growth and development.

Theoretical dimensions of growth-oriented atmosphere

In the earlier study dating back to 1998, Ruohotie and Nokelainen (2000) examined the theoretical dimensions of a growth-oriented atmosphere in the same organization as in the current study. The organization consisted of ten geographically separate units. The sample size was 318 employees, 66 percent out of the survey population of 479 employees. The target population was Finnish polytechnic institution of higher education personnel in 1998 ($n = 7{,}958$).

Both male ($n = 145$) and female ($n = 147$) respondents' group sizes were almost identical (46 percent) with 8 per cent ($n = 27$) missing data. Respondents' age was reported with four classes: 20 to 29 years (5 percent, $n = 17$), 30 to 39 years (25 percent, $n = 78$), 40 to 49 years (37 percent, $n = 120$), and over 50 years (24 percent, $n = 75$) with 9 per cent ($n = 29$) missing data. The job profile contained three groups (7 percent of missing data): managers (8 percent, $n = 25$), teachers (44 percent, $n = 139$) and other personnel, i.e. cleaner, caretaker, librarian (41 percent, $n = 131$).

Although the non-response rate was quite high in this study, the job title distribution of the sample (teachers: 44 percent, managers: 8 percent, other personnel: 41 percent, missing: 7 percent) was parallel both to the survey population (teachers: 47 percent, managers: 5 percent, other personnel: 48 percent) and target population (teachers: 63 percent, managers: 5 percent, other personnel: 32 percent) distributions derived from the public records.

The instrument utilized in the study contained 80 statements. The response options in a five-point summative rating scale (aka "Likert scale", see DeVellis, 2003, pp. 78-80) varied from 1 (strongly disagree) to 5 (strongly agree).

Ruohotie and Nokelainen (2000) constructed 14 summated scales (Hair *et al.*, 1995, p. 9) to represent the theoretical dimensions of growth-oriented atmosphere. The scales were formed on the basis of both theoretical aspects and the results of exploratory factor analysis (Maximum likelihood with Varimax rotation). The 13-factor solution was the most parsimonious representing 67 per cent of the variance within the 80 items. Eigenvalues were between 1.05 and 23.98. Respondents indicated only moderate differences in preferences for various dimensions as mean ratings ranged between 3.2 and 3.8. Internal consistency for each factor was estimated with Cronbach's alpha coefficient (Cronbach, 1970, pp. 160-1). The alpha values ranged from 0.77 to 0.93 ($M_{\alpha} = 0.84$).

Although the authors report continuous parameters such as mean and alpha on items measured with the non-metric ordinal scale, we consider the results plausible as the underlying phenomenon, a growth-oriented atmosphere is continuous by nature (Marini *et al.*, 1996). Johnson and Creech (1983) have studied with simulation studies the categorization error that occurs when continuous variables are measured by indicators with only a few categories. The results indicated that while categorization error does produce distortions in multiple indicator models, under most conditions explored the bias was not sufficient to alter substantive interpretations. However, authors warranted caution in the use of two-, three- or four-category ordinal indicators, particularly when the sample size is small. In the Ruohotie and Nokelainen (2000) study, as well as in the present study, the ordinal scale has five categories and the sample size to the number of the observed variables ratio is acceptable according to empirical and simulation studies (Cattell, 1978; Gorusch, 1983; MacCallum *et al.*, 1999). Further, according to Yeo and Neal (2008), recent research has shown that the psychometric properties of single-item measures can equal that of multi-item measures for a variety of psychological constructs, such as job satisfaction.

Ruohotie and Nokelainen (2000) found that growth-oriented atmosphere generates togetherness and reflects on developing leadership. Multidimensional scaling provided evidence to conclude that factors representing the incentive value of the job, commitment to work and organization, the clarity of the job and growth motivation are the strongest indicators of growth-oriented atmosphere. Ruohotie and Nokelainen (2000) made the following conclusions based on their research findings:

- teacher's professional growth-motivation reflects directly with task value on teacher-pupil relationships and on achievement motivation;
- task value has an effect on growth-oriented atmosphere; and
- growth-oriented atmosphere is the highest in work assignments that offer challenging professional tasks (manager, teacher) and lowest among other workers.

Method

Sample

A non-probability sample included employees that worked in a Finnish polytechnic institution of higher education during the year 2002. The organization is the same as in the 1998 study (Ruohotie and Nokelainen, 2000), but as the organization structure was re-arranged in 2000, the number of units has dropped from ten to eight. A total of 447 participants completed the questionnaire. The sample size is 87 per cent of the survey population of 512 workers, indicating 13 per cent non-response rate. The target population of Finnish polytechnic institution of higher education personnel in 2002 was 9,661. Non-response error was analyzed in the study by comparing job title distributions (manager/teacher/other) between the sample and public employee records. We conclude that the results of this study are to some extent generalizable to the target population of Finnish polytechnic institution of higher educations, as the target organization's job distribution resembles the job distribution of target population.

The average age of respondents' in the sample was 39 years (SD = 9.1, range 22-62). Respondents' job profiles were as follows (with 6 percent, $n = 27$ missing data): Teachers (48 percent, $n = 215$), managers (7 percent, $n = 30$) and other personnel (39 percent, $n = 175$).

A majority of the respondents were established employees (64 percent, $n = 287$), but the sample included also temporary (25 percent, $n = 109$), and part-time (6 percent, $n = 28$) workers. Of the managers, 80 per cent ($n = 24$) had established contracts and 20 per cent ($n = 6$) had a temporary contract. Over the half of the teachers (67 percent, $n = 143$) had established contracts, 21 (10 percent) had part-time, and 48 (22 percent) had temporary contracts. Other personnel had the following contracts: 66 per cent ($n = 115$) established, 3 per cent ($n = 6$) part-time and 29 per cent ($n = 51$) temporary, respectively.

Instrument

The Growth-oriented Atmosphere Questionnaire (GOAQ) used in this study was a modified version of the one developed during the Growth Needs project (Ruohotie, 1996). The theoretical basis for the structure of the instrument elicited from the works of Argyris (1972, 1992), Dubin (1977, 1990), Hall (1986, 1990), and Kaufman (1974, 1990). The latest version of the GOAQ is based on the research findings of the Growth Needs Project's previous research phase (Ruohotie and Nokelainen, 2000). The original instrument contained 92 items operationalizing 14 latent dimensions. Each item was measured in a five-point summative rating scale from 1 (strongly disagree) to 5 (strongly agree). According to the results of exploratory factor analysis for categorical variables (CEFA), the 67 strongest loading items were chosen to describe the 13 dimensions of the growth-oriented atmosphere model (see Table I). The dimension measuring students' attitudes toward teacher in the 1998 study was dropped out in the current study as it is relevant only for the teachers who represent 48 per cent of the sample. A demographics sheet was attached to the instrument enquiring respondents' position in the organization and nature of the contract.

Item		Data ($n = 447$) Median	Mode
Factor 1. Encouraging leadership (ENC)			
v5.	My manager is friendly and easily approachable	4.0	5
v6.	My manager pays attention to my suggestions and wishes	4.0	5
v7.	My manager works with a team to find solutions	4.0	4
v8.	My manager is fair	4.0	5
v9.	The employees in my organization are encouraged to develop new working methods and to think creatively	4.0	4
v10.	My manager trusts his or her staff and allows them to work independently	4.0	5
v11.	The organization promotes self-reliance and employees are encouraged to find new and improved working methods	4.0	4
v13.	The managers are interested in the wellbeing of staff	3.0	4
v14.	The management strives to improve the working conditions of staff	4.0	4
v15.	My goals were agreed in co-operation with my manager	4.0	4
v23.	Failures are dealt with in a constructive manner and employees are encouraged to learn from their mistakes	3.0	3
v25.	My manager has supported me in the past	4.0	4
v26.	My manager knows how to tap into the differing characteristics within the workforce	3.0	4
v27.	My manager has succeeded in strengthening the sense of unity in the workplace	3.0	3
v90.	This organisation values me as an individual	4.0	4
Factor 2. Strategic leadership (STR)			
v1.	The management of my organization provides a clear direction and highlights the key points in education	3.0	3
v2.	The management of my organization expresses and enforces accepted values both in spoken form and through its example	3.0	3
v3.	The management of my organization embodies distinct values and a clearly defined style of leadership	3.0	3
v4.	The management of my organization observes the latest educational developments and uses this information when planning the organization's activities	3.0	3
Factor 3. Know-how rewarding (REW)			
v20.	It is rewarding to achieve my goals	2.0	1
v21.	The organization rewards its employees' professional knowledge and skills	2.0	1
v22.	Employees with increased knowledge are given extra responsibility	3.0	3
v24.	The organization rewards employees for tackling demanding tasks	3.0	3
Factor 4. Know-how developing (DEV)			
v37.	The organization endeavours to always use the latest knowledge in the field	4.0	4
v38.	The organization's employees are given training to increase their professional skills	3.0	4

(*continued*)

Table I.
The growth-oriented atmosphere questionnaire

Item		Data ($n = 447$) Median	Mode
v39.	The organization takes an active interest in its employees' professional growth	3.0	3
v40.	The staff is given the latest information and professional literature	4.0	4
v41.	I am given the chance to learn new things and improve myself	4.0	4
Factor 5: Incentive value of the job (INV)			
v28.	I can work independently and without restrictions	4.0	4
v29.	I can use my skills at work in a variety of ways	4.0	4
v30.	My work consists of various differing tasks	4.0	5
v31.	My work gives me a sense of success and achievement	4.0	4
v32.	My work gives me personal satisfaction	4.0	4
Factor 6. Clarity of the job (CLA)			
v46.	A clear division of tasks exists between members of teaching staff	3.0	4
v47.	The organization's decision making structure is transparent	3.0	3
v48.	The organization's goals are transparent	3.0	4
v49.	The teachers know exactly what their colleagues expect of them	3.0	3
Factor 7. Valuation of the job (VAL)			
v42.	My manager appreciates my work	4.0	4
v43.	I am given encouraging feedback on my work	3.0	4
v45.	I feel that my work is valued	4.0	4
Factor 8. Community spirit (COS)			
v54.	The organization's staff feels personally responsible for achieving their goals	4.0	4
v55.	The staff maintains a demand for high performance	4.0	4
v56.	The staff possesses a sense of unity and a willingness to strive towards a common goal	4.0	4
v57.	My colleagues help me when necessary	4.0	4
v58.	The staff discusses improvements to work and/or their working environment	4.0	4
v59.	The staff presents new ideas about solving work-related problems	4.0	4
v60.	The staff wants to improve the quality of teaching	4.0	4
Factor 9. Team spirit (TES)			
v50.	I have ample opportunities to exchange work-related ideas and experiences with my colleagues	4.0	4
v51.	We tend to evaluate and analyze our work together to learn from it	3.0	3
v52.	We solve work-related problems together	4.0	4
v53.	We advise and guide each other on executing work-related tasks	4.0	4
Factor 10. Psychic stress of the job (PSY)			
v78.	I feel that I am beginning to dislike my work	2.0	2
v79.	I feel that it is getting more difficult for me to take the initiative	2.0	1
v80.	I find it difficult to concentrate	2.0	1

Table I. (*continued*)

Item		Data ($n = 447$) Median	Mode
Factor 11. Build-up of work requirements (BUI)			
v70.	My workplace has too few employees to cope with the workload	4.0	4
v72.	My workload has increased during the past years	4.0	5
v76.	My working pace has increased in recent years	4.0	4
v77.	I feel that I am experiencing fatigue	3.0	4
Factor 12. Commitment to work and organization (COM)			
v87.	I am happy in my present job	4.0	4
v88.	I want to continue in my present job; it gives me job satisfaction	4.0	4
v89.	I don't find going to work each morning disagreeable	4.0	5
v91.	I do not wish to change jobs	4.0	4
Factor 13. Growth motivation (GRM)			
v81.	I feel encouraged by having added responsibilities	4.0	4
v82.	I find self-improvement useful	5.0	5
v83.	I like to participate in all manner of improvement projects within the organization (such as training, team work and projects, exchanging duties, taking on additional tasks, etc.)	4.0	4
v84.	I am interested in further training, provided it speeds up my transfer to other, more challenging tasks	4.0	5
v85.	I like to experiment with new ideas	4.0	4

Note: Data = Employees of a Finnish polytechnic institution of higher education

Table I.

Procedure

The sample was obtained with non-probability sampling. Each employee of the organization was personally invited via e-mail to complete an online version of the GOAQ. The online questionnaire (Miettinen *et al.*, 2005) presented one to five questions at the same page allowing respondents to attach an open comment to each question.

Non-response error was analyzed by comparing the job profiles of the sample with survey population (teachers: 48 percent, managers: 6 percent, other personnel: 46 percent) and target population distributions (teachers: 57 percent, managers: 9 percent, other personnel: 34 percent) derived from public records. Comparison of the job profile distributions shows that the "other personnel" group is 12 per cent underrepresented in the sample when compared with the survey population. Teachers are 9 per cent underrepresented in the sample when compared with the target population. The sample distribution of job profiles is similar enough to survey and target population distributions to represent Finnish polytechnic institution of higher education personnel in this study.

Data analyses

Research questions in this study are addressed with unsupervised multivariate data analysis methods that allow ordinal indicators. Unsupervised methods (e.g., exploratory factor analysis) discover variable structure from the evidence of the data matrix as opposite to supervised methods (e.g., discriminant analysis) that assume a given structure (Venables and Ripley, 2002, 301). Unsupervised methods are further divided into four sub categories:

(1) visualization methods;
(2) cluster analysis;
(3) factor analysis; and
(4) discrete multivariate analysis.

The first research question is investigated with exploratory factor analysis for categorical indicators (CEFA), that is implemented in Mplus (Muthén and Muthén, 2001), and Spearman nonparametric rank-order correlations. The use of CEFA has two major advantages over traditional exploratory factor analysis. First, it allows the use of ordinal indicators as it is based on the categorical variable model developed by Bengt Muthén (1993). Second, it does not require multivariate normality as it applies the general asymptotic distribution free function instead of the usual maximum likelihood estimator (Muthén and Muthén, 2001).

The other three research questions are investigated in this paper with non-linear visualization methods. According to Venables and Ripley (2002), visualization methods are often more effective than clustering methods discovering interesting groupings in the data, and they avoid the danger of over-interpretation of the results as researcher is not allowed to input number of expected latent dimensions. In cluster analysis the centroids that represent the clusters are still high dimensional, and some additional illustration methods are needed for visualization (Kaski, 1997), for example, multidimensional scaling (Kim *et al.*, 2000). We apply in this study the BayMiner (www.bayminer.com/en) non-linear visualization modeling software as it is capable of analyzing both linear and non-linear dependencies between variables under investigation (Kontkanen *et al.*, 2000).

Results

Kerlinger (1986) classified weaknesses of rating scales into extrinsic and intrinsic. Extrinsic defect is that scales are way too easy to construct and use. Sometimes a scale is used to measure things that it is not designed to measure. This point was addressed with a pilot study of 12 respondents and an interview of the organizations development manager. The online questionnaire that was used for the pilot study was the near-final version allowing respondents to attach an open comment to each question. This procedure is quite close to what Fowler (1995, pp. 130-1) calls "field pre-test with observation" as with an online questionnaire we are able to ask item-specific comments and even track answering times for each item. The comments from the pilot study and interview were analyzed and wordings improved where necessary. The item structure from the pilot study was analyzed with Bayesian dependency modeling that is computationally robust also with small sample sizes. Results of the pilot study showed, for example, that the term "manager" was not clear to all the respondents. Further, some of them did not understand the difference between "management" and "manager". We solved this problem by adding clear definitions of the terms in the opening page of the questionnaire.

According to Kerlinger (1986, p. 495), intrinsic defect of rating scales is their proneness to constant error. He lists four main sources:

(1) halo effect;
(2) error of severity (to rate all items too low);

(3) error of leniency (to rate all items too high); and
(4) error of central tendency (to avoid all extreme judgments).

To examine intrinsic defect we analyzed the overall response tendency. Results show that the respondents used the whole scale from 1 (totally disagree) to 5 (totally agree) for all the items but one. The scale for item v82 ("I find self-improvement useful") ranged from 2 to 5. Mode frequencies that sum up to the number of items in the questionnaire were as follows: (1, strongly disagree) $n = 0$, (2) $n = 9$, (3) $n = 27$, (4) $n = 54$, (5, strongly agree) $n = 2$. This result is as overall distribution of the modes on a five-point summative rating scale is unimodal and only slightly biased towards positive values.

RQ1. *Relevance of the 13-factor growth-oriented atmosphere model*
Exploratory factor analysis for categorical indicators was conducted to solve the first research question: "Is the 13-factor model of growth-oriented atmosphere relevant to describe growth prerequisites of Finnish polytechnic institution of higher education employees?" In technical terms, our goal is to find the most relevant factorial structure for observed variables measuring growth-oriented atmosphere.

The GOAQ items were subject to categorical exploratory unweighted least squares factor analysis with Varimax rotation. An initial estimation yielded 14 factors with eigenvalues exceeding unity, accounting for 73 per cent of the total variance. Thirteen-factor Varimax-rotated solution, accounting for 71 per cent of the total variance, was found to be most interpretable in terms of meaningful clusters and correspondence to both theoretical and empirical findings of our previous research work. The root mean square residuals (RMSR) help the investigator to examine how well the aspects of the data are captured by the model (Loehlin, 2004, p. 70). RMSR value of 0.03 was well below a cut-off value of 0.08 (Hu and Bentler, 1999). Figure 1 presents the 13-factor model of the growth-oriented atmosphere. The individual items related to the dimensions are presented in Table I.

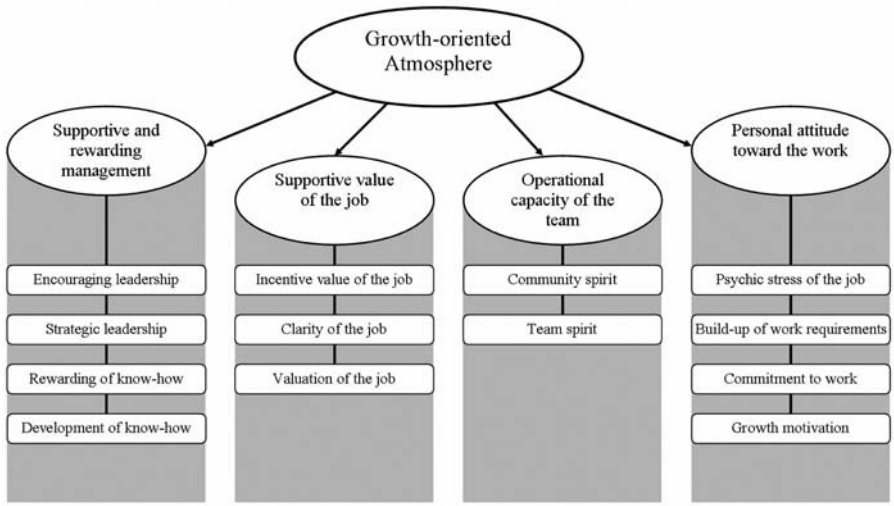


Figure 1.
Thirteen-factor model of the growth-oriented atmosphere

Dimensions derived from the factor analysis are strongly related to each other as the correlation coefficients presented in Table II are significant at the 0.01 level (two-tailed). Spearman bivariate coefficients range between 0.81 and −0.52. The average of all coefficients is 0.26 and the average of total variance explained is 7 per cent. Closer examination of the coefficients reveals, as expected, that growth motivation (GRM) is not affected by strategic leadership (STR), know-how rewarding (REW) or build-up of work requirements (BUI). It is also noteworthy to mention that psychic stress of the job (PSY) has the only positive correlation with build-up of work requirements.

Growth prerequisites of a polytechnic institution of higher education can be described with the help of the 12 dimensions that are presented in Table III. Students' attitude to teacher dimension that was present in the earlier solution of Nokelainen and Ruohotie (2000) was omitted from this model due to theoretical and technical reasons. Theoretical reason was that the factor is too tightly related to teaching, making it an irrelevant dimension for those employees who do not teach (i.e. managers and other personnel). The second, more technical point favoring rejection of the factor was that the items operationalizing the dimension were not selective enough (i.e. the full scale was not in use).

Internal consistency measures estimate how consistently individuals respond to the items within a scale. Reliability is, thus, a characteristic of the data in hand, and not of the test (Thompson, 1998). Table III shows both lower (Cronbach's alpha) and upper bound (Tarkkonen's reliability, see Vehkalahti, 2000) of such measures. The scores in our study range from 0.75 to 0.97 (Cronbach's alpha) and from 0.79 to 0.97 (Tarkkonen's reliability). The most reliable factor was encouraging leadership (ENC). This finding is partly due to fact that alpha values tend to get larger as the number of items grows (ENC was measured with 15 items as the other dimensions had three to seven items).

RQ2. *Validity of the four group classification of growth-oriented atmosphere factors*

Non-metric multidimensional scaling was conducted in order to answer the second research question: Is the theoretical four-group classification of the growth-oriented atmosphere factors valid for this sample? In technical terms, we examine what is the geometric two-dimensional structure of the components operationalizing growth-oriented atmosphere.

Figure 2 represents the structure of two dimensional distance measures between cases in our growth-oriented atmosphere data set. Euclidean distance as dissimilarity measure and distance scaling model was applied for ordinal data. First dimension classified components into two groups. First group contained factors representing operational capacity of the team: student's attitudes towards teacher (STA); growth motivation (GRM); incentive value of the job (INV); and work group cooperation (WOC). Factors in the second group were connected to supporting and rewarding management: rewarding for know-how (REW); strategic leadership (STR); and clarity of the job (CLA). Second dimension visualizes work-related stress: psychic stress of the job (PSY) and increase in the demands of the work (BUI) represent the negative end of scale, and encouraging leadership (ENC), valuation of the job (VAL), know-how developing (DEV), commitment to work and organization (COM), and community spirit (COS), the positive polarity (Figure 2.)

Growth-oriented atmosphere factors	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Encouraging leadership (ENC)	–												
2. Strategic leadership (STR)	0.39	–											
3. Know-how rewarding (REW)	0.65	0.54	–										
4. Know-how developing (DEV)	0.68	0.40	0.61	–									
5. Incentive value of the job (INV)	0.60	0.27	0.41	0.59	–								
6. Clarity of the job (CLA)	0.72	0.47	0.57	0.61	0.48	–							
7. Valuation of the job (VAL)	0.85	0.37	0.60	0.66	0.61	0.63	–						
8. Community spirit (COS)	0.55	0.32	0.39	0.55	0.46	0.48	0.56	–					
9. Team spirit (TES)	0.48	0.30	0.36	0.49	0.37	0.44	0.49	0.75	–				
10. Psychic stress of the job (PSY)	−0.30	−0.19	−0.21	−0.31	−0.40	−0.30	−0.35	−0.24	−0.23	–			
11. Build-up of work requirements (BUI)	−0.19	−0.19	−0.25	−0.16	−0.12	−0.20	−0.23	−0.06	−0.06	0.41	–		
12. Commitment to work and organization (COM)	0.55	0.34	0.42	0.49	0.61	0.47	0.58	0.36	0.32	−0.50	−0.28	–	
13. Growth motivation (GRM)	0.20	0.04	0.04	0.24	0.29	0.11	0.21	0.30	0.22	−0.23	0.03	0.19	–

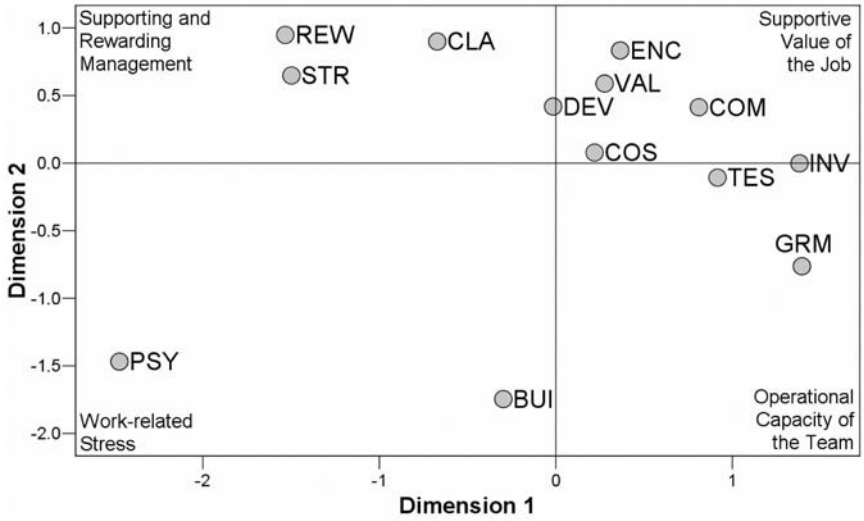
Note: Spearman rank order correlations (r_s) were calculated due to ordinal measurement scale

Table II.
Correlation coefficients of the 13 dimensions of growth-oriented atmosphere

Growth-oriented atmosphere factor		Description	α [b]	TR[c]
1.	Encouraging leadership (ENC)[a]	Management of the organization expresses and consolidates values that direct activities, monitors the development processes of units and defines the direction and focus of operations	0.97	0.97
2.	Strategic leadership (STR)	Manager supports and motivates personnel to develop know-how, work methods and work community. He takes advantage of work community member's expert knowledge and he tries to solve problems with them. He pays attention to the expectations and wishes of personnel	0.89	0.90
3.	Know-how rewarding (REW)	Organization rewards its employees' professional knowledge and skills. Members of work community gain more responsibility as their know-how increases	0.87	0.87
4.	Know-how developing (DEV)	Organization takes an active interest in its employee's professional growth. Members of work community are interested in self-developing	0.88	0.90
5.	Incentive value of the job (INV)[a]	Work gives intrinsic fulfilment by being versatile, autonomous and challenging	0.88	0.90
6.	Clarity of the job (CLA)	Personnel has a clear picture of goals and responsibilities. They are aware of decision-making processes and personal expectations	0.87	0.90
7.	Valuation of the job (VAL)[a]	Work contribution is respected by the worker itself, colleagues and management	0.88	0.90
8.	Community spirit (COS)[a]	How community members may learn from each other, for example via dialogue, by analyzing mistakes, participating in collaborative planning and quality development	0.92	0.93
9.	Team spirit (TES)	Good team spirit promotes helping each other and taking responsibility over common goals. Work group members discuss about developing work and working environment	0.87	0.88
10.	Psychic stress of the job (PSY)	To what extent work and changes relating to it induce psychic strain like fatigue flightiness	0.83	0.85
11.	Build-up of work requirements (BUI)	How to cope with changes in the personal workload	0.75	0.79
12.	Commitment to work and organization (COM)[a]	To be truly excited about one's work. How important it is to stay in current job	0.87	0.89
13.	Growth motivation (GRM)[a]	To trust ones abilities in difficult situations, take new challenges and develop ones know-how	0.80	0.81

Table III.
The 13 dimensions of growth-oriented atmosphere

Notes: [a] Common dimension as in the previous study in the same organization (Ruohotie and Nokelainen, 2000) with 80-item version of the questionnaire; [b] Cronbach's index of internal consistency; [c] Tarkkonen's reliability index



Note: ENC = Encouraging leadership, STR = Strategic leadership, REW = Know-how rewarding, DEV = Know-how developing, INV = Incentive value of the job, CLA = Clarity of the job, VAL = Valuation of the job, COS = Community spirit, TES = Team spirit, PSY = Psychic stress of the job, COM = Commitment to work and organization, GRM = Growth motivation

Figure 2.
The growth-oriented atmosphere factors in two-dimensional space (MDS, Euclidean distance model)

Examination of the coordinates for scaling Euclidean dimensions in two-dimensional space shows that growth motivation (1.3945) and incentive value of the job (1.1274) are the strongest components on the positive end of the first dimension and psychical stress of the job (− 2.4731) is strongest on the negative end together with rewarding of know-how (− 1.5332), and strategic leadership (− 1.4983). Stress value (0.049) indicates that the model fits to the data reasonably well. This result together with visual examination of the Figure 2 supports the earlier research finding suggesting that encouraging leadership (ENC) and commitment to work and organization (COM) are closely situated in the visual space, but in different dimensions.

RQ3. *Position and the nature of contract as predictors of growth motivation*

Bayesian model-based visualization is applied in this study to investigate the third research question: To what extent employees' position and the nature of contract are connected to growth motivation? With Bayesian unsupervised model-based visualization we may concentrate on singular summary factors and study each ones distribution dynamically.

Figure 3 is a visualization of the Bayesian network model. The window has following elements: Main window, attribute selection window (upper left corner), low profile window (lower left corner), initial profile window (lower right corner), and high profile window (upper right corner). The main window contains the model in which each dot stands for one respondent ($n = 447$). Attribute selection window shows the current component of interest and its discretization (i.e. the classes of data). In Figure 3, the component of interest is growth motivation (KM_GRM). Low profile window

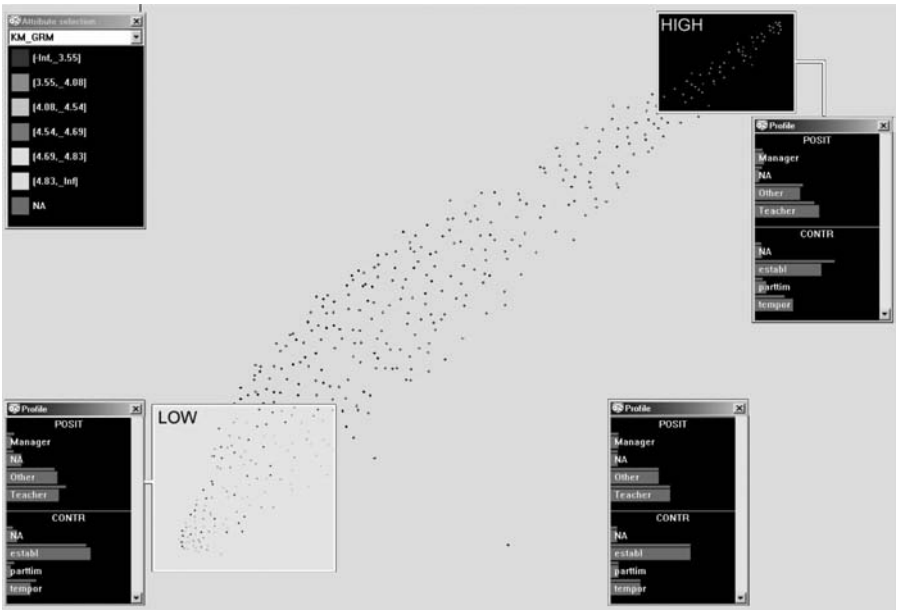


Figure 3.
Bayesian model-based visualization of growth motivation by employees' position and the nature of contract

shows the distribution of examined variables when sub sample represents the lowest values of the component, high profile window has the same functionality for the high end sub sample. Initial profile window shows the initial distribution of the examined variables. Thin bars in profile window represent initial values, thick bars values of the current sub sample.

The attribute selection window in the upper left part of Figure 3 shows that growth motivation scale is quite biased and thus the upper bound for the lowest category is 3.55. However, inspection of the values in high-scale profile window and high scale sub sample frame gives evidence that managers and teachers has distinguished representation in the highest category of growth motivation as the thick bar is taller than the thin bar that indicates the average value. It is interesting to observe that those respondents with the most insecure contracts, namely temporary and part-time, have higher growth motivation than their established colleagues (Figure 3).

RQ4. *Position and the nature of contract as predictors of commitment to the organization*

The fourth research question is to study to what extent employees' position and the nature of contract is connected to his or her commitment to the organization. Attribute selection window in the upper left part of Figure 4 shows that scale for commitment to work and organization is balanced: Upper bound for the lowest category is 2.92 and lower bound for the highest category is 4.76. Values in high-scale profile window and high scale sub sample frame suggest that managers and teachers have the highest level of commitment to work as the thick bar is taller than the thin bar indicating the average value. This result is parallel with our earlier research findings (Ruohotie and

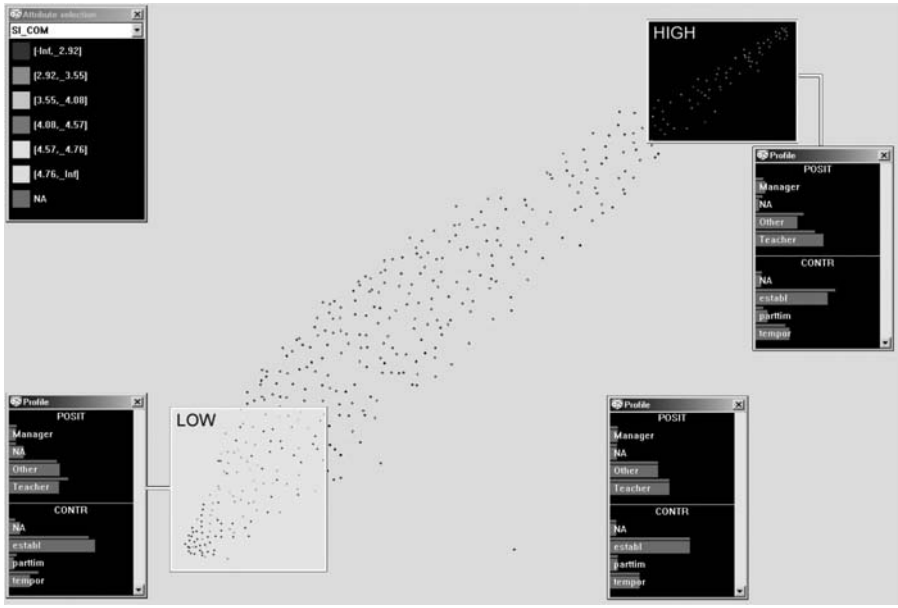


Figure 4.
Bayesian model-based visualization of commitment to work and organization by employees' position and the nature of contract

Nokelainen, 2000). Commitment to work and organization is highest among those respondents with the most insecure contracts (Figure 4).

Conclusion

We have examined dimensions of growth-oriented atmosphere in a Finnish polytechnic institution of higher education with categorical exploratory factor analysis, classical multidimensional scaling and Bayesian unsupervised model-based visualization.

Thirteen-dimension Varimax-rotated solution in the categorical factor analysis was found to be interpretable in terms of meaningful clusters and correspondence to both theoretical and empirical findings of previous research (Ruohotie and Nokelainen, 2000).

Results of two-dimensional scaling showed that the components on the negative end of the first dimension represent operational capacity of the team. Components on the positive end of the first dimension are related to supporting and rewarding management. Second dimension visualized work-related stress; the most components with the most negative coordinates were psychical stress of the job and increase in the demands of the work. Rewarding for know-how, clarity of the job assignments, and encouraging leadership represented the positive polarity of the second dimension. Research evidence suggests that the psychic stress caused by the work affects increasingly to the build-up of work requirements.

Discussion

The findings of a previous study (Ruohotie and Nokelainen, 2000) conducted in the same domain suggested that growth-oriented atmosphere generates togetherness and

reflects on developing leadership. Multidimensional scaling and Bayesian unsupervised model-based visualization both provided evidence to conclude that factors representing encouraging leadership and commitment to work and organization are closely situated in, but in different dimensions. Results further showed that managers and teachers had the highest growth motivation and level of commitment to work. Employees across all job titles in the organization with temporary or part-time contracts, had higher self-reported growth motivation and commitment to work and organization than their established colleagues.

A recent study among the employees of a US restaurant chain showed that conscientiousness was the best predictor of job performance against work experience, psychological atmosphere and work effort (Byrne *et al.*, 2005). Results indicated that being conscientious might not be enough to secure the highest levels of performance unless the individual is concurrently willing to work hard, and is a member of a psychologically secure work setting. In the current study, most of the employees were working with established contracts and the work performance was not measured, but still the results are comparable at least to some extent. Findings of both studies underline the importance of willingness to work hard (i.e. high growth motivation and valuation of the job) and psychologically secure work setting (i.e. low level of psychic stress, strong team and community spirit).

Finally, an interesting future research direction would be to study relationship between empowerment and management of change (Spreitzer *et al.*, 1999). Empowerment means the removal of constraints that prevent individuals from working to their optimal potential (Mills and Friesen, 1995). Perceived empowerment is a process that expands individual power in comparison to status quo or some solid end result. It will occur to varying degrees within any organization, and individuals will experience variable feelings of empowerment at different times (Koberg *et al.*, 1999). Thus, managers should be able to evolve innovative ideas, gain support from his/her superiors, and finally, encourage members of the work community to strive for a common goal.

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