

Service quality as goal and outcome of ergonomics research: user and employee perspectives

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Abstract: Ergonomics research needs to design organizational level, occupational health interventions that contribute to improving organizational performance so as to become of practical relevance for management. This paper analyses a study evaluating the impact of such interventions on user satisfaction and service quality. The study conducted an employee survey with 754 preschool teachers in 98 Danish preschools and a user survey among 8116 parents. Significant correlations were found between well-being and service quality measures from both employees and users indicating a link between traditional ergonomic outcomes and organizational performance. Consequently, ergonomics research may benefit from including measures of organizational performance.

Keywords: Ergonomics research, service quality, organizational performance, user and employee perspectives.

1. Introduction

The purpose of organizational level, occupational health (OL-OH) interventions is to improve employees' health and safety. At medium to large workplaces with a formal occupational health and safety (OHS) organization, such interventions are typically initiated by employee representatives or by regulatory authority inspections. HR consultants may initiate OHS initiatives if economic benefits such as increase in performance or reduced employee sickness absence are in sight. In small companies without formal OHS activities, the leader-owner will be the typical initiator; mainly if there is a clear economic potential or if the company is pressured to do so (Hasle, Kines, & Andersen, 2009). OHS competencies and attention of leader-owners are typically limited, so outcomes are ambiguous (Sørensen, Hasle, & Bach, 2007). Consequently, unless grounded in specific regulatory requirements, it is unlikely that workplace management will initiate OL-OH interventions if there is not a clearly visible performance benefit for the organization.

Scandinavian countries' legislation require all companies (except very small) to establish formal, locally embedded OHS-organizations and requirements for workplace risk assessments are strong (Walter, 2002). Even in this context, researchers have shown that OHS activities become 'sidelined' because they are not perceived as relevant in the organizations' main chain of command (Hasle & Jensen, 2006; Jensen, 1997). This 'sidelined' position of OHS activities is even more evident in research based OL-OH interventions. Kristensen (2005:209) concludes that "the activities of almost all occupational intervention studies are still 'sideline' activities that are not directly relevant for the *core tasks* of the workplace" (original emphasis).

To become of practical relevance for management, ergonomics research needs to be able to design OL-OH interventions that can show measurable improvements in organizational performance. The sociotechnical design theories presented early attempts to integrate company objectives and human outcomes, e.g. the focus of Rise (1958) on *primary tasks* as a central notion encompassing managers' interest in sound business and employees' interests in meaningful tasks and activities. These early sociotechnical design theories experimented with workplace changes aimed at improving productivity and health in integrated job designs (Sandberg, 1995; Thorsrud, 1977). A recent review of the management tool *lean* showed that especially in contexts with traditions of sociotechnical design, employee outcomes can be positive (Hasle, Bojesen, & Jensen, 2010). However, another review showed that such rationalization tools and initiatives have predominantly negative effects on workers' health and mental health (Westgaard & Winkel, 2011). Recent research has shown positive effects of interventions with an integrated focus on occupational health and job performance (Tsutsumi, Nagami, Yoshikawa, Kogi, & Kawakami, 2009), quality of patient care (Weigl, Hornung, Angerer, Siegrist, & Glaser, 2013), and productivity improvements using lean (Seppälä & Klemola 2004).

In conclusion, ergonomics research may need to design interventions that take the *primary tasks* of the workplace at the outset, while integrating the aims of productivity improvements or improved quality and health and safety outcomes. However, there is a need for even more research on how such interventions can be designed, what the performance outcomes may be, and how such outcomes may be measured. This article intends to illustrate how performance measures can be integrated into OL-OH interventions, and how such measures have been introduced to evaluate their impact on service quality in the case of an intervention in selected Danish public pre-schools.

2. Methods

The project was conducted in public child care centres for children aged 0-6 in a large Danish municipality from 2011 to 2013. This study uses baseline data from 2011. Participants were leaders, preschool teachers, teaching assistants, and support personnel. The OL-OH intervention in the project aimed at improving the working environment in the child care centres taking outset in improving the primary tasks. The research group selected 98 centres with 10 or more employees with the highest short term sick leave rates (>9.8; up to 14 consecutive days). Workplaces had 10 to 58 employees. Arbejdsmiljøforskningsfonden funded the research. ID: 28-2010-03; grant: £440.000.

The child care centres being part of the same municipality, their working conditions are comparable in terms of overall organizational strategy and structure, HRM policies, economical frames, staff-child ratios, work descriptions, union affiliation, etc. The municipality's mission for the child care centres is to provide: "good development, challenging education, and a healthy childhood for the children ... to achieve a good and meaningful life with others". Each care centre may define its own pedagogical line to fulfil these goals. A local pedagogical leader manages each care centre. Each centre employs a mixture of preschool teachers ('pædagog') and teaching assistants ('pædagogiske assistenter'). The teachers hold a 3.5 year full time professional degree. The teaching assistants are unskilled or have an education of shorter duration. The preschool teachers are typically responsible for the general pedagogical line and development in collaboration with the pedagogical leader. Therefore, in this study we focus on the preschool teachers' evaluation of service quality.

The project distributed a paper-based confidential six-page questionnaire to employees and administered a short web-based survey to parents. The questionnaires were approved by the project steering group with representatives from central management, unions and HR. Local managers were notified about the surveys by the central HR department. Employee questionnaires were delivered and collected by project members. Local managers and employee representatives distributed the questionnaires. All employees had the possibility to fill out the questionnaire during work time. Time used was compensated by the project. The employee questionnaires were collected in anonymous, prepaid envelopes that could be mailed should the employee prefer to do so. Parents received a letter with information about the web-based survey and a unique code.

In total, employees returned 1745 valid, completed questionnaires. The overall response rate was 86%. Child care centre response rates ranged from 47% to 100% with only three centres with a rate below 66%. The study included responses from 754 preschool teachers with a mean age of 41.9 (SD = 10.7); 89.5% were women. In total, parents returned 2200 valid, completed questionnaires. The overall response rate was 29%. Drop-out analyses indicate that the sample is free from any biases in terms of ethnical background, socioeconomic status or educational level.

The project developed three question batteries to measure the employees' perception of service quality: nine domain specific questions about *organizational service performance* (how good is your organization at...?), nine domain specific questions about *individual task priority* (what would you prioritize...?), and five general questions about *primary task quality* (can you perform your work in an adequate quality?). Well-being was measured using four questions selected from the Danish work environment cohort study and the Copenhagen Psychosocial Questionnaire: burn-out and job-satisfaction (Kristensen, Hannerz, Hogh, & Borg, 2005; Madsen, Diderichsen, Burr, & Rugulies, 2010). Control measures were: age, gender, position and type of institution. Eleven questions selected from Municipality Denmark's user satisfaction survey³ measured parents' perception of service quality within four themes: *user satisfaction* (2), *physical milieu* (2), *dialogue* (3), and *care activities* (4). All response categories were Likert scales (values: 1-5: 'A very low' to 'A very high' degree – except for the job satisfaction category with values: 1-4). Tables 1-3 below show the translated questions.

The analysis strategy we have applied below is to first perform factor and correlation analyses. Subsequently, to construct scales, we merge the two datasets, and finally using employee and user scales we apply a multi-level general linear model (GLM) and then a GLM model on aggregated organizational data..

3. Results

The factor analyses of the domain specific *service performance* questions indicate a two factor structure ($p < .0001$). Three questions loaded on both factors: working with colleagues, documenting pedagogical work, and dialogue with parents. Ranking the *individual task priority* questions (Table 2, two right columns) indicate that employees perceive these three activities as less important than direct relations with the children. Therefore, the *service performance scale* is composed of six questions related directly to working with the children. The factor analyses of the five *primary task quality* variables indicate a two factor structure ($p < .0001$). A closer inspection of the variables and results shows that theoretically the two questions with the weakest loadings measures a different

³ <http://www.kl.dk/Aktuelle-temaer/kvalitetsportalen/Brugerundersogelser/-Sporgeskemaerne/>

construct: *primary task focus*, i.e. the ability to focus on the most salient tasks. These variables are omitted from the *primary task quality scale* and the primary task focus scale is not used in this paper. The three *burnout* variables have a one factor structure ($p < 0.0001$) and are aggregated to a scale. *Job satisfaction* appears as a single item. Correlations between *service performance* variables (Table 1) and the other employee variables (Table 2) are below 0.5. To keep it simple, they are displayed in separate tables.

Table 1. Correlations between task quality variables and task priority mean values⁴

| How good the day care institution at... | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Mean | SD |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------|------|------|------|
| 1. Nursing and caring for the children | 0.90 | 0.72 | 0.61 | 0.59 | 0.58 | 0.45 | 0.47 | 0.39 | 0.30 | 1.17 | 0.44 |
| 2. Creating close relations to each child | 0.72 | 0.90 | 0.67 | 0.60 | 0.60 | 0.44 | 0.48 | 0.35 | 0.30 | 1.64 | 0.77 |
| 3. Creating condition for social interaction between the children | 0.61 | 0.67 | 0.90 | 0.68 | 0.62 | 0.49 | 0.49 | 0.44 | 0.40 | 1.73 | 0.77 |
| 4. Creating conditions for general child development | 0.59 | 0.60 | 0.68 | 0.90 | 0.80 | 0.49 | 0.48 | 0.48 | 0.42 | 1.79 | 0.80 |
| 5. Developing children's skills and competencies | 0.58 | 0.60 | 0.62 | 0.80 | 0.90 | 0.53 | 0.50 | 0.44 | 0.46 | 1.86 | 0.85 |
| 6. Using daily routines as learning opportunities | 0.45 | 0.44 | 0.49 | 0.49 | 0.53 | 0.90 | 0.41 | 0.39 | 0.36 | 1.89 | 0.84 |
| 7. Cooperating with parents | 0.47 | 0.48 | 0.49 | 0.48 | 0.50 | 0.41 | - | 0.46 | 0.42 | 2.02 | 0.91 |
| 8. Discussing task solutions with colleagues | 0.39 | 0.35 | 0.44 | 0.48 | 0.44 | 0.39 | 0.46 | - | 0.48 | 2.50 | 1.02 |
| 9. Documenting pedagogical work | 0.30 | 0.30 | 0.40 | 0.42 | 0.46 | 0.36 | 0.42 | 0.48 | - | 3.32 | 1.12 |
| Mean | 4.33 | 4.11 | 3.92 | 3.98 | 3.90 | 3.91 | 4.09 | 3.47 | 2.94 | | |
| SD | 0.75 | 0.80 | 0.83 | 0.81 | 0.82 | 0.83 | 0.74 | 0.92 | 0.94 | | |
| N | 745 | 743 | 744 | 744 | 742 | 743 | 744 | 743 | 745 | | |

Table 2. Correlation between outcome variables and general task quality.⁴

| | 1 | 2a | 2b | 2c | 3a | 3b | 3c | 3d | 3f | Age |
|--|-------|-------------|-------------|-------------|-------------|-------------|-------|-------|-------------|-------|
| 1. How satisfied are you all-in-all with your job? | - | -0.44 | -0.40 | -0.27 | 0.49 | 0.45 | -0.16 | -0.20 | 0.43 | 0.01 |
| 2a. Do you lack energy? (last two weeks). | -0.44 | 0.76 | 0.58 | 0.53 | -0.45 | -0.38 | 0.14 | 0.22 | -0.37 | 0.09 |
| 2b. Do you feel restless? (last two weeks). | -0.40 | 0.58 | 0.76 | 0.46 | -0.34 | -0.30 | 0.17 | 0.18 | -0.29 | 0.09 |
| 2c. Do you have trouble sleeping? (last two weeks). | -0.27 | 0.53 | 0.46 | 0.76 | -0.26 | -0.23 | 0.11 | 0.16 | -0.26 | -0.11 |
| 3a. Can you perform your tasks in a satisfactory quality | 0.49 | -0.45 | -0.34 | -0.26 | 0.77 | 0.52 | -0.15 | -0.23 | 0.55 | -0.01 |
| 3b. If you stress than things could be improved, will they be changed? | 0.45 | -0.38 | -0.30 | -0.23 | 0.52 | - | -0.18 | -0.17 | 0.51 | -0.01 |
| 3c. Do you have to perform tasks that seem unnecessary? | -0.16 | 0.14 | 0.17 | 0.11 | -0.15 | -0.18 | - | 0.45 | -0.21 | 0.02 |
| 3d. Is your work time used on tasks that are not your primary task? | -0.20 | 0.22 | 0.18 | 0.16 | -0.23 | -0.17 | 0.45 | 0.77 | -0.26 | -0.01 |
| 3e. Do the frames permit you to perform your tasks adequately? | 0.43 | -0.37 | -0.29 | -0.26 | 0.55 | 0.51 | -0.21 | -0.26 | 0.77 | -0.04 |
| Age | 0.01 | 0.09 | 0.09 | -0.11 | -0.01 | -0.01 | 0.02 | -0.01 | 0.04 | - |
| Mean | 3.06 | 1.95 | 0.95 | 1.15 | 2.77 | 2.82 | 1.66 | 1.64 | 2.61 | 41.88 |
| SD | 0.63 | 1.16 | 1.10 | 1.35 | 0.98 | 1.12 | 0.95 | 0.94 | 1.13 | 10.69 |
| N | 739 | 744 | 738 | 740 | 748 | 746 | 736 | 744 | 744 | 754 |

The factor analyses of the user satisfaction variables indicate that the data have a two-factor structure ($p < .0001$). The milieu and dialogue variables load on both these factors, indicating that parents' perception of daily activities is most closely related to general satisfaction. Consequently, the milieu and dialogue questions have been omitted. The remaining six variables compose a *service quality* scale.

Table 3. Correlations between user satisfaction variables⁴

| How satisfied are you (with)(the care takers Q7.x)... | Q4.1 | Q4.2 | Q5.1 | Q5.2 | Q6.1 | Q6.2 | Q6.3 | Q7.1 | Q7.2 | Q7.3 | Q7.4 |
|---|-------------|-------------|------|------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Q4.1 all-in-all with the day-care service | 0.83 | 0.72 | 0.44 | 0.31 | 0.63 | 0.58 | 0.60 | 0.64 | 0.57 | 0.65 | 0.62 |
| Q4.2 the daily activities | 0.72 | 0.83 | 0.41 | 0.35 | 0.53 | 0.55 | 0.56 | 0.56 | 0.55 | 0.62 | 0.55 |
| Q5.1 the indoor facilities | 0.44 | 0.41 | 0.62 | 0.45 | 0.28 | 0.32 | 0.28 | 0.33 | 0.33 | 0.34 | 0.32 |
| Q5.2 the outdoor facilities | 0.31 | 0.35 | 0.45 | 0.62 | 0.17 | 0.22 | 0.21 | 0.21 | 0.23 | 0.22 | 0.22 |
| Q6.1 the dialogue with the care takers | 0.63 | 0.53 | 0.28 | 0.17 | 0.86 | 0.64 | 0.74 | 0.65 | 0.58 | 0.66 | 0.62 |
| Q6.2 how you are included in decisions | 0.58 | 0.55 | 0.32 | 0.22 | 0.64 | 0.86 | 0.66 | 0.49 | 0.48 | 0.54 | 0.48 |
| Q6.3 the care takers attention to your views | 0.60 | 0.56 | 0.28 | 0.21 | 0.74 | 0.66 | 0.86 | 0.61 | 0.56 | 0.65 | 0.59 |
| Q7.1 effort to make your child feel safe and welcome | 0.64 | 0.56 | 0.33 | 0.21 | 0.65 | 0.49 | 0.61 | 0.92 | 0.73 | 0.76 | 0.78 |
| Q7.2 effort to create contact between your child and other children | 0.57 | 0.55 | 0.33 | 0.23 | 0.58 | 0.48 | 0.56 | 0.73 | 0.92 | 0.75 | 0.70 |
| Q7.3 effort to react to your child's needs | 0.65 | 0.62 | 0.34 | 0.22 | 0.66 | 0.54 | 0.65 | 0.76 | 0.75 | 0.92 | 0.76 |
| Q7.4 nursing of your child | 0.62 | 0.55 | 0.32 | 0.22 | 0.62 | 0.48 | 0.59 | 0.78 | 0.70 | 0.76 | 0.92 |
| Mean | 4.09 | 3.85 | 3.77 | 3.89 | 4.03 | 3.50 | 3.93 | 4.36 | 4.14 | 4.04 | 4.30 |
| SD | 0.87 | 0.99 | 0.97 | 1.00 | 1.00 | 1.01 | 0.95 | 0.84 | 0.88 | 0.95 | 0.82 |
| N | 2201 | 2193 | 2200 | 2198 | 2199 | 2114 | 2164 | 2187 | 2096 | 2164 | 2183 |

Detailed analyses of correlations between the employee scales and user scales show that the general *user satisfaction* scale (two questions) has the strongest correlations with

⁴ Correlations with absolute values above 0.076 have $p < 0.05$; values above 0.5 have $p < .0001$ (bold). The two right columns in table 2 show employee responses to task priorities questions. Diagonal: Cronbach's alphas.

the employee scales⁵ (table not included). Therefore, the analyses in this article use the general *user satisfaction* scale instead of the *service quality* scale.

ICC values in Table 4 indicate that the employee data have a multi-level structure. Multi-level analyses were performed to take advantage of intra-class covariance and to control for institution type, gender, and age (no effects – table not included). These multi-level analyses of the relation between the variables show that the relations between *primary task quality* and *user satisfaction* is the strongest compared to the other employee scales (estimate: 0.50, $p < 0.005$). The ICC values indicate that the organizational component of *primary task quality* is considerably higher than the other scales. It was not possible to include all scales in the same multi-level model because it loses too many degrees of freedom. Therefore, as an alternative, all scales were aggregated and analysed in one comprehensive GLM model. Table 4 shows that of the four employee scales, only *primary task quality* has a significant relation to *user satisfaction* (0.34, $p < 0.05$) thus indicating that the primary task quality scale is a better predictor for user satisfaction than the domain specific *service performance* measure. The correlation analysis (table not included) shows medium correlations between the other employee scales and *user satisfaction* (0.20-0.40, $p < 0.05$).

Table 4 GLM model: User satisfaction in relation to employee scales.

| Dependent variable: <i>user satisfaction</i> | Estimate | SE | t Value | Pr > t | ICC |
|--|-------------|-------------|-------------|-------------|------|
| Intercept | 2.35 | 0.75 | 3.14 | 0.00 | |
| Service performance | 0.01 | 0.15 | 0.06 | 0.96 | 0.17 |
| Primary task quality | 0.34 | 0.15 | 2.23 | 0.03 | 0.62 |
| Job satisfaction | 0.12 | 0.17 | 0.72 | 0.47 | 0.19 |
| Burnout | 0.06 | 0.13 | 0.48 | 0.63 | 0.17 |

4. Discussion and Conclusion

The primary purpose of this article was to describe how quality related performance measures can be integrated into OL-OH intervention research. The analyses show that users' perception of quality is significantly related to the professionals' assessment but that the correlation is medium and thus far from direct. Consequently, professionals' self-assessments may be used, but improvements in this measure may not be noticed by all users. This also means that if an OL-OH intervention aims to improve the performance of primary tasks as perceived by the professionals, e.g. through a participatory intervention, the improvements may not reflect directly in improved user satisfaction.

The relation between the professionals' assessments and user satisfaction is stronger for the general than the domain specific measure. We had expected that domain specific questions about workplace excellence, rather than general questions would be a better predictor of the adequacy of service quality and framing conditions. The positive side of this result is that these three general questions can be directly applied to other sectors too. We were also surprised to find that the strongest correlations between the user and employee measures are between the scale composed of the two general user questions rather than the specific user questions. Consequently, if the purpose is to evaluate the effect of an OL-OH intervention on user evaluated service quality outcomes, it would be enough to put forth these two general user questions. If the purpose is to measure impacts on specific service components, more discriminative questions may need to be developed.

Finally, the analyses find relatively strong correlations between the employee measures:

⁵ Including direct correlation between questions about dialogues in both surveys.

job satisfaction, burnout and primary task quality (about 0.7, $p < 0.0001$, at organizational level – table not included). Although common source bias may affect the result, this indicates that if OL-OH interventions can increase the level of primary task quality, these interventions would also increase job satisfaction levels and decrease levels of burnout. Thereby, the intervention would have positive effects on both employees' health and safety and organizational performance. Consequently, ergonomics research may benefit from including measures of organizational performance in their work. This conclusion, however, needs to be tested in a longitudinal design.

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