



Coping with information overload in email communication: Evaluation of a training intervention

Roman Soucek*, Klaus Moser

School of Business and Economics, University of Erlangen-Nuremberg, Lange Gasse 20, 90403 Nürnberg, Germany

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ABSTRACT

The present paper introduces three facets of information overload in email communication: A large amount of incoming information, inefficient workflow, and deficient communication quality. In order to cope with these facets of information overload, a training intervention was developed and evaluated. Data were collected from 90 employees on several evaluation levels within a longitudinal evaluation design (one pretest double posttest design). The results reveal that the training contributed to an increase in knowledge and media competencies. We also found evidence for a transfer of training contents to the workplace. Finally, strain diminished on several dimensions. In particular, problems with media usage and work impairment decline significantly, an effect that was stronger for those participants who face a large amount of email at their workplaces.

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1. Introduction

During the last decades, email communication has found its way to the workplace and has become an inherent part of today's working life (Dabbish & Kraut, 2006). Email communication became popular due to its key advantage; easy and rapid exchange of information that simplifies communication in large and geographically distributed organizations (Sproull & Kiesler, 1991). In fact, Rice and Bair (1984) believed that the use of electronic media would increase both personal and organizational productivity (see also Crawford, 1982). However, due to the increasing diffusion of email communication in organizations, the volume of email received has steadily increased to the point where concerns have been raised as to whether email contributes to employees' "information overload" (e.g., Dabbish & Kraut, 2006; Edmunds & Morris, 2000; Farhoomand & Drury, 2002). Preliminarily, information overload can be defined as experiencing a large amount of information that exceeds an individuals' information processing capacity (Schultze & Vandenbosch, 1998). Though a considerable number of articles on information overload due to emails can be found in the popular press (e.g., Musgrove, 2007; Stross, 2008), only more recent research has both accumulated systematic evidence for increased information overload at the workplace and revealed its impact on strain (e.g., Hair, Renaud, & Ramsay, 2007). For example, Moser, Preising, Göritz, and Paul (2002) found evidence that information overload due to email communication is related to increased psychosomatic complaints and to less job satisfaction.

In respect of these problems, the aim of the current paper is the development and evaluation of a training intervention that enhances a more effective use of email communication, and therefore strives to cope with information overload. In the following we first specify the contents of such a training intervention. Afterwards we describe and report the results of an evaluation study that assesses the effectiveness of the training intervention.

2. Coping with information overload in the context of email communication: A training intervention

In order to derive the issues that should be addressed by a training intervention, we first introduce three facets of information overload in the context of email communication, namely a large amount of incoming information, inefficient workflow, and deficient communication quality.

2.1. Facets of information overload

2.1.1. Large amount of incoming information

There are several causes of the increase in the amount of email messages. Besides the steadily growing diffusion of email communication in general, the "ease of communication" leads to an augmentation of sent and received emails. Sending emails to a multitude of recipients requires only a modicum of effort since they do not have to be printed out and delivered to a post office. The consequence of this increased quantity of emails is obvious: Inboxes become jam-packed and result in a confusing mixture of relevant and irrelevant emails, which hinders efficient information processing (Whittaker & Sidner, 1997). In fact, the term

* Corresponding author. Tel.: +49 911 5302 245; fax: +49 911 5302 243.
E-mail address: roman.soucek@wiso.uni-erlangen.de (R. Soucek).

“information entropy” describes email users’ experience of incoming messages not being sufficiently organized by topic or content, nor of being easily recognized as important or as part of the history of communication on a given topic (Hiltz & Turoff, 1985).

2.1.2. Inefficient workflow

A large amount of incoming messages combined with inappropriate working habits may impair information processing capacity and therefore promote information overload (Whittaker & Sidner, 1997). For example, Lantz (1998) concluded that those employees reporting problems with emails are not those who received and sent the most emails, but those who have not developed an effective structure for filing incoming emails, e.g., in separate folders. Whittaker and Sidner (1997) used the term “email overload” to describe the dysfunctional use of email programs beyond their basic communication functions. For example, the collection of “To-do-emails” in the inbox can contribute to a cluttered and fragmented inbox, the result being that users lose track of their tasks (Bellotti, Ducheneaut, Howard, Smith, & Grinter, 2005; see also Dabbish & Kraut, 2006). Another challenge to efficient workflow is interruptions. New emails steadily reach recipients (Jackson, Dawson, & Wilson, 2001; Kraut & Attewell, 1997; Whittaker & Sidner, 1997), resulting in continuous interruptions and in loss of control over the receiving of information (Hiltz & Turoff, 1985). As a result, decision-making performance suffers, especially during completion of complex tasks (Speier, Valicich, & Vessey, 1999).

2.1.3. Deficient communication quality

Up to this point, information overload has been characterized as the delivery of too many messages to be able to properly deal with or to respond to (e.g., Farhoomand & Drury, 2002). Beyond this quantitative issue, email messages are often deficient in their quality. For example, compared to business letters, email communication is often considered a spontaneous and less formal communication medium (Nantz & Drexel, 1995). This notion of email communication often leads to superficially and ambiguously formulated messages that fail to give the recipients enough information to act upon, and therefore fosters misunderstandings (Burgess, Jackson, & Edwards, 2005; see also Friedman & Currall, 2003). In addition, social and contextual cues are often missing in email communication, rendering messages even more difficult to understand (Sproull, 1991). Finally, email messages can contribute to ambiguity because communication rules are not well developed (Kiesler, Siegel, & McGuire, 1984). One example of ambiguity due to unclear communication rules occurs when senders expect recipients to respond to a message within a short time frame (Markus, 1994; Renaud, Ramsay, & Hair, 2006).

2.2. Addressing information overload

Information overload results from a discrepancy between the amount of information people receive and (the limits of) their information processing capacity (Schultze & Vandenbosch, 1998). Accordingly, there exist two general approaches to reducing information overload, (1) reducing the amount of incoming information and (2) enhancing recipients’ information processing capabilities. Intervention strategies that aim to reduce the amount of incoming email can address various levels: Technical interventions concern features of corporate email systems that help to administer email, e.g., filters that automatically sort out unsolicited emails. Organizational interventions concern, e.g., the implementation of email policies that provide guidelines for email use at the workplace like an adequate use of the carbon copy (cc) function (see Barron & Yechiam, 2002). Our paper presents a training intervention that aims to deal with information overload at the individual level by enhancing information processing. Relating to the facets of information

overload a training intervention should improve media competencies in order to cope with a large amount of email, improve personal workflow, and enhance email literacy.

2.2.1. Improving media competencies

The increased amount of incoming emails results in a mixture of relevant and irrelevant messages, which hinders efficient information processing. In order to cope with the given amount of email, a training intervention must enhance the participants’ knowledge and readiness to use functions that permit a more efficient handling of incoming emails (see also Ducheneaut & Watts, 2005). For example, an email client can collect and file incoming emails according to pre-defined criteria like sender, date, topic, etc. (Dabbish & Kraut, 2006). This “email classification” helps to pre-structure a recipient’s inbox and therefore supports subsequent information processing (Whittaker, Bellotti, & Gwizdka, 2007; see also Dredze, Lau, & Kushmerick, 2006). Another example is to highlight emails received in carbon copy (“cc emails”) with another color in order to distinguish them from emails that are directly targeted to the recipient and therefore may be more important. In sum, the enhancement of media competencies that facilitate the management of incoming emails should help to reduce email overload. However, a training intervention should exceed the mere demonstration of functions provided by email programs, i.e., training should take into account an appropriate utilization of email functions at the workplace (see also Whittaker et al., 2007). In particular, categorizing and filing of emails (Whittaker & Sidner, 1997) as well as setting up appropriate structures of folders should be addressed (Lantz, 1998). That way, the training not only presents various technical means for coping with a high amount of incoming information but encourages the participants to decide what functions would be useful at their particular workplaces.

2.2.2. Improving personal workflow

Appropriate self-management techniques can help to optimize information processing, e.g., priority setting and task management (Whittaker et al., 2007). For example, a training intervention should recapitulate the principles of task management and address how these principles can be effectively implemented within email programs (e.g., definition of special folders, marking emails with flags, reminders, etc.). Furthermore, interruptions of work tasks by incoming emails occur when email communication has not been efficiently integrated into personal workflow and task management (Whittaker, Bellotti, & Gwizdka, 2006). In order to address this issue, one strategy can be to perceive email communication as a daily task that is subject to scheduling and workflow management. For example, an employee can schedule his emailing activities every two hours. In order to avoid interruptions in the meantime, the email program could be closed or the new email alert box could be turned off (Jackson, Dawson, & Wilson, 2003). Note that the aim of a training program should be to advise the trainees on how to modify or extend their already existing self-management techniques to email management that fits their working routines. For example, a recent study suggested that under certain conditions, frequent checking of incoming email can reduce email overload (Dabbish & Kraut, 2006).

2.2.3. Enhancing email literacy

In order to cope with superficial and ambiguous communication, a respective training intervention should address basic principles of email communication. Participants should learn how to write effective subject lines and write emails that are more concise and to the point (Jackson, Burgess, & Edwards, 2006). Further topics are targeting of emails (see also Kimble, Hildreth, & Grimshaw, 1998) and handling of email attachments. Basically, trainees should learn when to communicate via email. In this context, users

of email communication should be aware of the strengths and limitations of this particular communication device. Therefore, a training intervention should foster a discussion about the adequacy of email communication for a given purpose. For example, emails are clearly appropriate for routine tasks and for statement of facts (Lantz, 1998; Lea, 1991), whereas issues that need further interpretation should be conveyed by “richer” media, e.g., by telephone or face-to-face communication (Daft & Lengel, 1984; Lee, 1994). Overall, the reason for including the enhancement of email literacy into the training intervention is that if employees adequately use email communication themselves, they can accomplish their work tasks more efficiently and would get lesser requests upon their concise written emails.

2.3. Criteria of training effectiveness and research hypotheses

The previous sections introduced three facets of information overload in the context of email communication and explicated issues that should be addressed by a training intervention, first, enhancing media competencies in order to cope with a large amount of incoming email, second, improving personal workflow, and finally, enhancing email literacy with regard to adequate communication. From the perspective of the training's effectiveness, the participants' knowledge and readiness to use functions and to follow principles that permit a more efficient email communication should be enhanced. Hence, participants should improve their knowledge and apply what they have learned to the workplace. [Hypotheses 1 and 2](#) summarize these assumptions.

Hypothesis 1. The knowledge of email functions is higher after the training than before the training.

Hypothesis 2. The application of email functions at the workplace is higher after the training than before the training.

The training intervention should help to cope with problems resulting from information overload. With regard to the three facets of information overload, the training intervention should result in a reduced level of problems with media usage due to a large amount of incoming emails and lower levels of work impairment by means of an improved personal workflow. Furthermore, enhancing email literacy should result in a decline of superficial and ambiguous communication. These assumptions are summarized by the [Hypotheses 3a–3c](#).

Hypothesis 3a. Problems with media usage are lower after the training than before the training.

Hypothesis 3b. Work impairment is lower after the training than before the training.

Hypothesis 3c. Superficial and ambiguous communication is lower after the training than before the training.

Moreover, because previous research found that information overload is related to strain (Moser et al., 2002; see also Mano & Mesch, 2010), we expect that the training intervention should contribute to a lower level of strain in the context of email communication. [Hypothesis 3d](#) summarizes this as follows.

Hypothesis 3d. Email strain is lower after the training than before the training.

However, these effects are expected to depend on the intensity of the respective stressor, i.e., the reduction of strain should be particularly observed if a considerable amount of information overload

existed beforehand. Therefore, we expect a reduction of problems associated with email overload especially for those participants who are facing a large amount of email. This assumption is summarized for the four strain measures by the [Hypotheses 4a–4d](#).

Hypothesis 4a. Participants who are facing a large amount of incoming email show a stronger decrease in problems with media usage than participants with a small amount of email.

Hypothesis 4b. Participants who are facing a large amount of incoming email show a stronger decrease in work impairment than participants with a small amount of email.

Hypothesis 4c. Participants who are facing a large amount of incoming email show a stronger decrease in superficial and ambiguous communication than participants with a small amount of email.

Hypothesis 4d. Participants who are facing a large amount of incoming email show a stronger decrease in email strain than participants with a small amount of email.

3. Evaluation study

3.1. Participants

We conducted 16 training sessions in six companies from the sectors of automation engineering, pharmaceuticals, travel, and accounting. In total, 162 participants voluntarily attended the training sessions (group sizes varied between 8 and 13 persons). Data were collected during three points in time, and 56% percent of the trainees sent back all questionnaires, resulting in a final sample size of 90 participants. The average age of the participants was 39.92 years ($SD = 8.68$), and their mean time of employment was 17.74 years ($SD = 9.68$). Female participants were in the majority with 60%. The participants had been working with emails for 7.22 years on average ($SD = 3.02$). A proportion of 47% of the participants received more than 20 emails daily. Twenty-six percent of the participants were executives.

3.2. Procedure

The current training is based upon the principles of cognitive-behavioral skills training, which have previously been successfully applied in the context of general stress management interventions (e.g., van der Klink, Blonk, Schene, & van Dijk, 2001). In particular, the current training intervention follows the approach of behavioral modeling, i.e., trainees observe a model that demonstrates certain skills and then reenact the model's behavior, a technique that has revealed as an effective method of computer skills training (Chou, 2001; Davis & Yi, 2004; Simon & Werner, 1996; Yi & Davis, 2003). The training sessions took place in classrooms of the employees' organizations. Each participant used a Personal Computer with an installed email program, the same as used at the workplace. All six companies used the same email program. The training intervention consisted of three parts: Improving media competencies, improving personal workflow, and enhancing email literacy.

The first part of the training started with instructions about functions of email programs that are useful for coping with a high amount of email, whereas the second part concentrated on principles of effective personal workflow. These instructions were accompanied by a demonstration of the relevant functions, following principles of behavior modeling (e.g., Yi & Davis, 2003). In par-

ticular, behavior modeling consisted in the explanation and demonstration of several email functions and principles of efficient email communication. The trainer showed the application of these functions on an overhead screen and participants repeated the demonstrated behavior. Afterwards, the trainees were encouraged to explore these functions themselves and to apply their knowledge within an interactive scenario. Within this scenario, the participants took the role of an employee of a fictional enterprise and received emails from their virtual colleagues. These emails represented several business procedures and encompassed typical problems of email communication, as identified in earlier research on information overload (e.g., Burgess et al., 2005; Moser et al., 2002). For example, the participants received newsletters, spam mails, and faced poorly formulated and incoherent business emails. The participants' task was to apply the previously learned techniques, e.g., filtering, categorizing, analyzing of emails, and responding to emails. Participants received feedback on the effects of their strategies from the scenario itself as well as from the trainer and from other trainees. For example, when participants decided to use certain automatic filters in order to organize their incoming emails, the consequences and usefulness of these filters became obvious in subsequent exercises, namely after having received additional emails. Finally, every exercise was ended with a discussion of the results between the trainees and the trainer. The third part of the training emphasized writing of emails as well as the appropriateness of email communication in general. Therefore, the nature of the exercise changed; for example, poorly formulated emails were displayed on the overhead screen and discussed by the trainees and the trainer. In addition, the trainer as well as the trainees provided recommendations for "best practice". Trainees then decided on, which rules they wanted to use at their workplaces. They received a template form that assisted them to agree on email policies within their workgroups or between project members. The third part of the training addressed issues similar to the sender training described by Burgess et al. (2005).

3.3. Evaluation design

The study consisted of a three-wave survey within a pre–post design with one follow-up assessment. We began with the collection of data two weeks before the training. The second questionnaire followed immediately after the training. Finally, we distributed the third questionnaire three to four weeks after the training. We gathered data on the following evaluation levels: Knowledge of email functions, application of email functions at the workplace, and strain. Knowledge and application of email functions were assessed at three points in time, whereas strain was assessed at pretest and posttest 2. Please note that pretest data and posttest 2 data relate to the workplace, whereas posttest 1 data relate to the training context.

We collected data with paper-and-pencil questionnaires at posttest 1 and with web-based surveys at pretest and posttest 2. In order to match pre- and post-training data, participants marked their questionnaires with a unique anonymous code. The matching of pre- and post-measures was verified by a profile analysis of demographic variables that were gathered at all three measuring points. All statistical analyses of the longitudinal data were conducted with variance analyses for repeated measures.

3.4. Measures

3.4.1. Knowledge of email functions

Trainees rated their knowledge of 10 basic (e.g., use of folders) as well as more advanced functions of email programs (e.g., automatic filing of emails). Note that all functions were presented and

discussed during the training sessions. The participants' knowledge was assessed using the following categories: "I do not know this function", "I have heard about this function", and "I know how to apply this function". In order to aggregate the ratings, we summed up the number of functions that the participants reported to have already known how to apply, resulting in an index ranging from 0 to 10 functions.

3.4.2. Application of email functions

Transfer of training contents means the application of email functions at the workplace (e.g., "How often do you utilize rules for automatic sorting and filing of incoming emails?"). Transfer was assessed on 7-point rating-scales anchored from "not at all" (=1) to "very frequently" (=7). The scale midpoint was anchored with "sometimes" (=4). Finally, we computed the mean of these items in order to obtain an index for the application of the email functions presented in the training session.

3.4.3. Strain

In order to assess the strain of the trainees, we used four scales that were developed in previous research (Moser et al., 2002; Preising, 2004): Problems with media usage, work impairment, superficial and ambiguous communication, and email strain. The scales were assessed on 7-point rating-scales anchored from "does not apply at all" (=1) to "fully applies" (=7). *Problems with media usage* focus on the quantity of received information and on related problems (5 items). A sample item is: "Due to the information flood, I am facing problems when I am working with emails". The scale *work impairment* stressed disruptions of workflow by emails (5 items). High scores on this scale meant that emails absorbed so many resources (information processing capacity) that task performance suffered (Sample item: "The accomplishment of my email correspondence takes so much time, so that other tasks are neglected."). *Superficial and ambiguous communication* concerned superficiality of work due to deficient email communication (5 items). A high score on this scale reflected ambiguous and inaccurate communication via email and related problems (Sample item: "Misunderstandings often occur between me and my colleagues because they read my emails superficially."). Finally, *email strain* covered general negative emotional reactions related to email communication (8 items). A sample item is: "I quickly become annoyed when problems with emails occur". The reliabilities (Cronbach's alpha) of these scales are as follows: Problems with media usage, $\alpha = .80$, work impairment, $\alpha = .93$, superficial and ambiguous communication, $\alpha = .70$, and email strain, $\alpha = .86$. These reliabilities are comparable to a previous study (problems with media usage, $\alpha = .80$, work impairment, $\alpha = .82$, superficial and ambiguous communication, $\alpha = .73$, and email strain, $\alpha = .89$; $N = 195$; Preising, 2004).

Further evidence for the psychometric quality of these scales are as follows: First, a previous study found that retest reliabilities are satisfactory, problems with media usage, $r = .82$, work impairment, $r = .89$, superficial and ambiguous communication, $r = .75$, and email strain, $r = .89$ (Preising, 2004; $N = 60$; four week interval between test and retest). Second, in another study (Preising, 2004; $N = 195$), problems with media usage and email strain were positively related to psychosomatic complaints ($r = .17$, $p < .10$ respectively $r = .34$, $p < .01$; one-tailed tests), and both scales were negatively related to job satisfaction ($r = -.16$, $p < .10$ respectively $r = -.18$, $p < .10$; one-tailed tests) as well as work impairment ($r = -.21$, $p < .05$; one-tailed test). Third, though information overload should not be simply equated with the amount of email received, a certain degree of relationship should be expected. In fact, in the current study we found significant correlations between the amount of email and three strain scales before the training (problems with media usage, Kendall's tau, $\tau = .16$, $p = .01$; work

impairment, $\tau = .28$, $p < .01$; superficial and ambiguous communication, $\tau = .06$, $p = .21$; psychological strain, $\tau = .15$, $p = .02$; N between 149 and 151; one-tailed tests). Note that superficial and ambiguous communication was not related to the amount of email received, which seems quite plausible since this scale measures qualitative deficits of email communication that are distinct from the amount of email received.

4. Results

In the following, we report the results of the evaluation study. In particular, we test our assumptions whether the participants improved their knowledge of email functions (*Hypothesis 1*) and whether they apply what they had learned at the workplace (*Hypothesis 2*). Furthermore, we inspect whether the training intervention results in a decrease of strain (*Hypotheses 3a–3d*). We also test the more specific assumption that the decline in strain is stronger for those participants who face a large amount of email at their workplaces (*Hypotheses 4a–4d*).

In order to control for selective dropout, we compared participants who returned all three questionnaires to those participants who did not. No significant differences occurred with regard to pretest measures of strain, problems with media usage, $T(147) = -0.01$, $p = 1.00$, work impairment, $T(149) = -1.90$, $p = .06$, superficial and ambiguous communication, $T(148) = 1.03$, $p = .31$, and email strain, $T(148) = -1.30$, $p = .20$ (two-tailed T -tests).

4.1. Knowledge of email functions

Hypothesis 1 assumes that the participants improve their knowledge of email functions that support an efficient email communication. The participants rated their knowledge of 10 overall functions of email programs at three measurement points. Two weeks before the training sessions, the subjects indicated an average of 3.76 functions they already knew how to apply ($SD = 1.78$). At posttest 1, the participants' knowledge rose to 8.84 functions ($SD = 1.45$) and dropped to 8.01 ($SD = 2.33$) in posttest 2. An ANOVA for repeated measures reveals a significant change between pretest and posttest 2, $F(1, 89) = 201.72$, $p < .01$, indicating an increase of knowledge over time. Thus, *hypothesis 1* is confirmed.

4.2. Application of email functions

Hypothesis 2 assumes an increase in the application of email functions after the training compared to before the training. Concerning the application of email functions, it is possible to analyze data from three different points in time, though the change between pretest and posttest 2 deserves more attention because this difference reflects a change at the workplace and thus the transfer of training contents. Essentially, the usage of email-functions increased from 2.96 ($SD = 0.84$) in the pretest to 5.87 ($SD = 0.88$) in posttest 1 and dropped to 4.39 ($SD = 0.87$) in posttest 2. Again, we computed ANOVAs for repeated measures (pretest and posttest 2). The change over time for training transfer was highly significant, $F(1, 88) = 163.70$, $p < .01$, confirming *hypothesis 2*. Overall, the usage of email functions not only improved after the training session, but also resulted in a change at the workplace.

4.3. Strain

Table 1 depicts the descriptive statistics of the four strain measures before and after the training (posttest 2). Overall, the mean scores declined to a considerable extent for three of the four scales, namely problems with media usage, work impairment, and email strain.

Table 1

Strain measures at pretest and posttest 2.

Strain measure	Pretest		Posttest 2	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Problems with media usage	3.40	1.24	2.44	1.09
Work impairment	3.66	1.58	2.96	1.34
Superficial and ambiguous communication	2.96	1.26	3.08	1.11
Email strain	2.43	1.13	2.25	1.07

The training intervention strived to enhance information processing in order to reduce information overload and its negative consequences, namely problems with media usage, work impairment, superficial and ambiguous communication as well as email strain (*Hypotheses 3a–3d*). However, as already noted, we expect a reduction of strain, more so if a certain amount of information overload existed beforehand (*Hypotheses 4a–4d*). In order to test these assumptions we computed ANOVAs for repeated measures and considered (measurement) time as the within-subjects factor and the amount of email as the between-subjects factor. With regard to *hypotheses 3a–3d* we expect main effects of time. Concerning the *hypotheses 4a–4d* we expect interaction effects of time and the amount of email. In particular, strain should decline to a higher extent in case participants receive a large amount of email.

4.3.1. Problems with media usage

Fig. 1 depicts the means of problems with media usage for pretest and posttest 2, separated for a small and large amount of email. Overall, trainees who had a large email load reported generally more problems with media usage than persons with a small amount of email, $F(1, 85) = 6.68$, $p = .01$ (main effect of the amount of email). This substantiates the notion that the amount of email contributes to problems resulting from information overload. *Hypothesis 3a* assumed that problems with media usage are lower after the training than before the training. In fact, the results reveal that problems with media usage decreased significantly over time, $F(1, 85) = 61.18$, $p < .01$ (main effect of time). Thus, *hypothesis 3a* is confirmed. Furthermore, *Fig. 1* clearly depicts that the decline in problems with media usage was more pronounced for those employees with a large amount of email. In fact, the change in time of problems with media usage depends on the amount of email, $F(1, 85) = 8.43$, $p < .01$ (interaction effect of time and the amount of email). With regard to the descriptive measures in *Fig. 1* and the significant interaction effect, *hypothesis 4a* is confirmed.

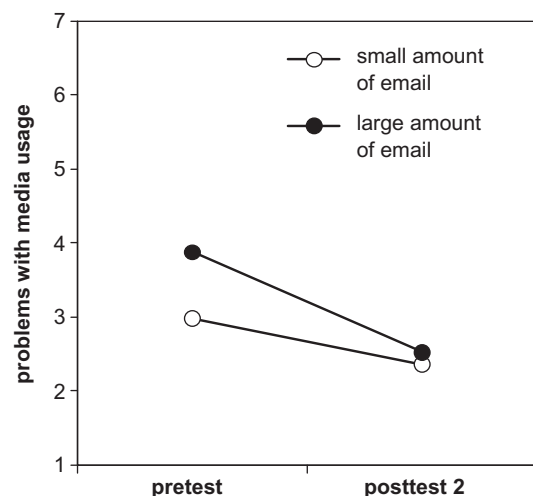


Fig. 1. Problems with media usage before and after the training.

4.3.2. Work impairment

Fig. 2 reveals the change in work impairment over time, again separated for a small and large amount of email. Again, trainees who experienced a large amount of incoming email reported more work impairment in general, $F(1, 87) = 10.72, p < .01$ (main effect of the amount of email). Hypothesis 3b assumed a decrease of work impairment over time. This hypothesis can be confirmed, work impairment was lower after the training than before, $F(1, 87) = 28.94, p < .01$ (main effect of time). In addition, the decline in work impairment depended on the amount of email, $F(1, 87) = 7.60, p < .01$ (interaction effect of time and the amount of email). Again, participants reporting a large amount of email experienced a greater decline in work impairment. Thus, hypothesis 4b is confirmed.

4.3.3. Superficial and ambiguous communication

The means for superficial and ambiguous communication are depicted in Fig. 3, again separated for time of assessment and amount of email. Concerning superficial and ambiguous communication, the main effect for the amount of email is marginally significant, $F(1, 87) = 3.07, p = .08$, indicating a trend for higher levels of superficial and ambiguous communication in case of a large amount of email (main effect of the amount of email). However, no decline of superficial and ambiguous communication can be observed over time, $F(1, 87) = 1.65, p = .20$ (main effect of time). Thus, hypothesis 3c is not confirmed. Also, the results do not indicate a different change in time due to the amount of email, $F(1, 87) = 1.28, p = .26$ (interaction effect of time and the amount of email). Hypothesis 4c is not confirmed. Overall, the training had no effect on superficial and ambiguous communication.

4.3.4. Email strain

Fig. 4 depicts the change in time for email strain, separated for participants who experience a small respectively large amount of email. Overall, participants with a large amount of email reported a higher extent of email strain, $F(1, 84) = 4.69, p = .03$ (main effect of the amount of email). Furthermore, Fig. 4 depicts a decline in email strain over time that revealed itself as marginally significant, $F(1, 84) = 3.57, p = .06$ (main effect of time). Regarding this solely marginally significant result, hypothesis 3d is not confirmed. Furthermore, the results do not indicate a different change in time in dependence of the amount of email, $F(1, 84) = 1.59, p = .21$ (interaction effect of time and the amount of email). Thus, hypothesis 4d is not confirmed.

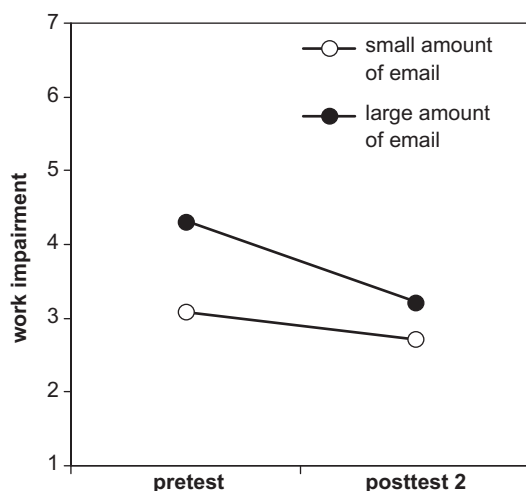


Fig. 2. Work impairment before and after the training.

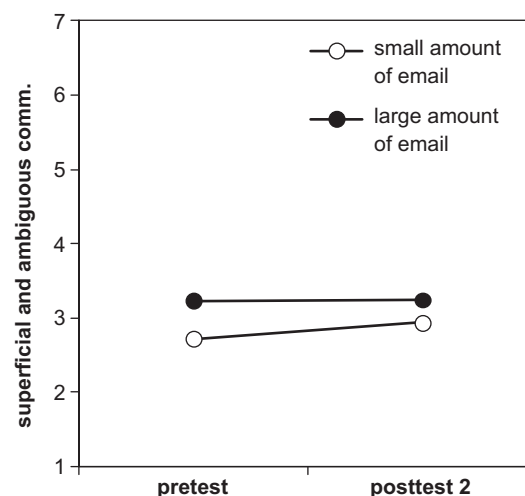


Fig. 3. Superficial and ambiguous communication before and after the training.

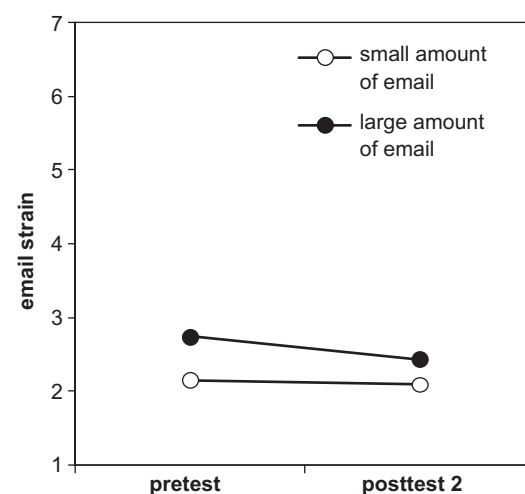


Fig. 4. Email strain before and after the training.

5. Discussion

Information overload in the context of email communication has several facets to explore, the most common being: High volume of received information that exceeds the recipient's information processing capacity (Schultze & Vandenbosch, 1998), ineffective personal workflow (Lantz, 1998; Whittaker et al., 2006), and deficient communication quality such as ambiguously written emails (Burgess et al., 2005). We derived three main issues for a training intervention designed to cope with information overload: Improvement of media competencies in order to cope with a large amount of email, improving personal workflow, and enhancing email literacy. Note that the training goes beyond the mere teaching of specific computer skills. The aim is to promote an appropriate usage of email functions as well as to facilitate an understanding of the adequacy of email communication in different situations. In particular, the third part of the training stresses the handling of email communication, discussing "good practice", and making trainees aware of "bad practice".

Overall, the training intervention we introduced in the current paper was successful. In fact, we found effects on several evaluation criteria: The participants improved their knowledge of email functions and transferred the training contents from the training context to the workplace. Finally, strain declined in three of four dimensions. In particular, the trainees reported fewer problems

with media usage and less work impairment. Hence, the training helps to cope with the amount of email received and reduces trainees' feelings of being overwhelmed and disrupted by incoming information. Furthermore, the training intervention has a marginally significant effect on email strain, in general. However, the results reveal no effect concerning superficial and ambiguous communication, i.e., the trainees still perceive email communication as more ambiguous compared to alternative communication media, like face-to-face communication or telephone.

More specifically, the training intervention was particularly effective with respect to coping with a large amount of email. This notion could be confirmed with regard to problems with media usage and work impairment. An important question is why the training is effective. Whereas our theoretical perspective refers to the improvement of individual resources, namely information processing, an alternative explanation might be that the training simply helped participants to reduce the number of emails they normally receive. However, our data do not support this assumption. In fact, the amount of email received did not change over time (Wilcoxon-Test, $Z = -1.51$, $p = .23$). Thus, we assume that the causes for the alleviation of information overload are due to enhanced information processing abilities of participants.

Conceptually, our training intervention is comprehensive from the vantage point of email research, which has repeatedly been bemoaned because of its segmentation into a collection of separate research fields (Ducheneaut & Watts, 2005; see also Rudy, 1996). Ducheneaut and Watts (2005) use the following metaphors to describe the different directions of email research: First, there is the notion of email as a sort of "file cabinet", with respective research being interested in cognitive aspects of receiving, organizing, and retrieving of information in email systems. Second, there is the view of email as a production facility, and hence, a part of computer-mediated communication. This approach addresses the effective design of computer-mediated workflow. Finally, some researchers analyze email as a communication genre and discuss its advantages and constraints in comparison with other communication channels. The current training program adopted all three directions of email research. It takes into account media competencies (e.g., handling and filing of incoming information), personal workflow (e.g., making email communication subject to scheduling respectively task management), and email literacy (e.g., making appropriate use of email).

5.1. Limitations

5.1.1. Time frame

Any training intervention should be discussed with respect to the sustainability (vs. relapse) of the training effects in general, and the transfer to the work environment in particular. Therefore, we collected data both at the end of the training sessions and three weeks after the training. We decided to analyze the difference between pretest and posttest 2 data. There are two reasons why we consider the data collected immediately after the training as less relevant. First, the measures of posttest 1 are related to the training context, whereas pretest and posttest 2 data are related to the workplace. Thus, the difference between pretest and posttest 2 reflects changes at the workplace. Second, we were interested in a sustained increase of knowledge respective of application of email functions rather than short-timed effects directly after the training session. In fact, our data suggest a slight deterioration of the training effects over time, i.e., between posttest 1 and posttest 2.

Considering strain, the picture is more complex. Whereas significant effects were observed for problems with media usage and work impairment, one reason for the smaller effects on email strain could be the short time distance between training session and measurement at posttest 2. That is, a considerable reduction

of email strain may only emerge in the long run. In order to capture the respective effects, future research should assess email strain after more time has elapsed, e.g., three months after the training. Nevertheless, given the multidimensionality of strain, it is quite unlikely that the email training has strong effects on strain *in general*. Note also that the scale "superficial and ambiguous communication" might be less sensitive to measuring training effects because change of scores depends on both the behavior of the trainees and other people (e.g., co-workers, customers).

5.1.2. Measures

Use of self-report measures for the assessment of strain is both common and appropriate because strain is experienced by the trainees (see also Cooper, Dewe, & O'Driscoll, 2001). However, concerning the measurement of knowledge and behavior, our results should be considered with some degree of caution. A test of objective knowledge (i.e., testing what has been learned) or the use of observers instead of self-reports are possible supplements in future studies. For example, Jackson and colleagues monitored and recorded employees' activities with a remote desktop system (Jackson et al., 2003).

5.1.3. Evaluation design

Unfortunately, we were not able to convince the organizations to increase the number of participants of the study and set up a non-training control group. However, we should briefly comment on the problems that might result from a study lacking a control group. Two important issues are trainee maturation and testing effects (Shadish, Cook, & Campbell, 2002). Considering maturation, we acknowledge that at least some problems with new technologies might be due to a simple lack of experience. However, trainees in our evaluation study had a considerable amount of work experience in general and with email communication in particular. Therefore, we estimate that it is very unlikely that some maturation effects parallel with the delivery of the training sessions. In addition, evidence against the existence of both maturation and testing effects can be found in a retest study (Preising, 2004), which did not find any decrease on the same strain scales between the first and the second measurement point. Furthermore, in the current study, effects on the strain scales were different depending on the amount of email that training participants received. Thus, a general testing effect can be ruled out because it would have led to comparably uniform changes in scale scores independent of scale content.

5.1.4. Composition of trainees

Since trainees participated voluntarily, the training groups were quite heterogeneous. This is especially important with regard to the third part of the training intervention: Improving email communication by means of enhancing email literacy respectively communication rules. As the reduction of superficial and ambiguous communication depends not only on one's own manner of communication but also on the recipients, this part of the training might be less effective because regular "communication partners" – who of course should agree with these communication rules – were not available in the training sessions. In fact, training effects should be higher when all members of existing working groups participate in the training session – enabling formal or informal peer training (see Fulk, 1993) – or when the trainees have the opportunity to disseminate the rules to their co-workers. Because the current study was conducted with participants from various workgroups, the effectiveness of the training regarding superficial and ambiguous communication can be expected to emerge only after a considerable time (if at all).

5.2. Implications and directions for future research

The current evaluation study has both practical implications and suggests directions for future research. The results reveal that the training intervention was particularly effective for trainees who have to cope with a large amount of email. For example, decrease in reported problems with media usage and work impairment is stronger for employees who face a large amount of email. Therefore, the presented training intervention can be even more recommended to employees who have to cope with a high volume of emails. A specific target group of the training intervention could be home-based workers who are faced with a high volume of emails and report higher levels of work distress (Mano & Mesch, 2010). This type of workers has limited opportunities for face-to-face communication in order to discuss work-related issues, which need further clarification or interpretation. Rather home-based workers are bound to media-based communication like email or telephone, and therefore, should be made aware of the strengths and weaknesses of these various communication media and their appropriate usage.

The training intervention paid attention to several facets of information overload. However, research shows that certain problems related to email communication (“email defects”) vary between users (Burgess et al., 2005). For example, employees with higher job grades are receiving more emails compared to employees with lower job grades (Burgess et al., 2005). Sales representatives may not have the opportunity to retrieve their emails while visiting several customers, and therefore are regularly confronted with an overloaded inbox after returning to their offices. The work of senior managers involves greater equivocality in communication contents that can be better resolved by a direct and synchronous communication medium like face-to-face communication rather than paperbound or electronic communication (Markus, 1994). These examples illustrate that different users have to tackle varying problems in email communication. In a similar vein, Mano and Mesch (2010) conclude that the assessment of the benefits and costs of email communication should consider individual characteristics. Overall, detailed knowledge about specific problems and consequences of email communication should provide fruitful starting points for the development of specific training interventions and recommendations for various groups of employees.

A more “conceptual enlargement” of the training intervention could be as follows. Whereas the current training intervention focuses on the *individual* level, recent research has strongly recommended *comprehensive* stress interventions, i.e., trainings should go beyond interventions on the individual level and should also pay attention to organizational-level factors like organizational policies concerning email communication that provide guidelines for email use at the workplace (Munz, Kohler, & Greenberg, 2001; Murphy, 1996; van der Klink et al., 2001). Such policies can contribute to the development of (better) communication rules or a “common perspective” in the organization, and therefore, reduce superficial and ambiguous communication (see Boland & Tenkasi, 1995; Clark & Brennan, 1991).

Another direction of future research is the relationship of email communication and job performance. The current paper has a focus on email communication as a source of strain. From a more general organizational behavior perspective, the evaluation of training interventions should not only focus on problems that could be prevented but also on the effects of email communication on work performance (see Mano & Mesch, 2010).

6. Conclusions

Overall, the evaluation study showed that individual resources preventing information overload could be successfully improved

by means of training. In particular, the training intervention enhances processing of a given amount of incoming email, and helps to reduce several facets of strain in the context of email communication. However, in order to enforce training effects, it is recommendable to train members of existing workgroups together. That way, a common understanding and use of email communication can be disseminated within organizational units. Furthermore, according to comprehensive stress interventions, trainings should also pay attention to organizational-level factors like organizational policies concerning email communication (Munz et al., 2001; Murphy, 1996; van der Klink et al., 2001). Of course, email-trainings could also be an incentive to develop such policies if they are currently non-existent.

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