How does e-mail use affect perceived control of time?

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A B S T R A C T

It is well established in the psychology literature that personality predicts performance to some degree. However, personality neither solely nor directly predicts outcomes. Rather, performance and outcomes unfold through context-specific mediating constructs. This study identified two constructs that mediate the relationship between proactivity and perceived control of time in e-mail use and tested the model with data from 251 knowledge workers. The results show that proactivity predicts the perceived control of time in e-mail use through both e-mail-specific time management behavior and e-mail self-efficacy. Further, greater e-mail self-efficacy leads to improved e-mail-specific time management behavior.

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1. Introduction

Advances in communication technology have made communication more convenient but have also accelerated the pace of our lives. During the past three decades, e-mail has evolved from an Internet application used only by technology specialists to a common communication tool that is embraced by the general population. E-mail has influenced our lives both positively and negatively. Positive aspects, such as task accomplishment and life enrichment, are accompanied by negative consequences, such as greater perceived time pressure.

E-mail today is characterized by both a large volume of messages and diversity in information formats. The variety of available e-mail attachment types facilitates the diversity of information formats, which both accelerates the growth in the size of e-mail messages and increases the burden on users processing such messages [2,31]. E-mail has gradually penetrated the daily life of knowledge workers, and it imposes high costs [32]. Although the literature on e-mail management does not provide a complete account of these costs, time is undoubtedly at the top of the list. Time costs may include the time-related pressure that knowledge workers experience as a result of e-mail [1].

However, the rise of social networking sites on the Internet has changed how we use online media, and many speculate that the popularity of social networking sites will lead to a decrease in e-mail use. If e-mail use is indeed decreasing among knowledge workers, then the time costs associated with e-mail will become a lesser problem. However, to date, the effects of time costs impact on e-mail use is uncertain. In the organizational context, e-mail remains the most popular communication tool because many organizational policies block access to social networking sites from the office. Thus, e-mail usage in the workplace is not expected to decline because of the popularity of social networking sites.

People have a tendency to overestimate passive durations and underestimate active durations of time. The time spent accessing e-mail systems and handling e-mail messages is characterized by activeness rather than passiveness and may thus be underestimated. Weber [37] stated that many people feel that their lives are ruled by e-mail to the extent that heavy users do not even view the constant entering and exiting of e-mail systems as disruptive [25]. Although convenient, e-mail creates a situation in which knowledge workers are constantly on call, whether they are in the office, at home, or on vacation. In other words, frequent interruptions accompany the convenience that e-mail brings [4,36]. With e-mail, work is also expected to be performed more rapidly. This pressure is closely linked to the perceived control of time in e-mail use.

Davenport [9] found that on average, 77% of knowledge workers check their e-mail frequently, causing frequent interruptions and damaging productivity, and 51% felt that they were not in control of their information flow. In addition, approximately 20% of knowledge workers acknowledge their inability to manage information well; however, few individuals are willing to stop

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using e-mail as a communication tool. The volume of e-mail messages handled is also rapidly increasing, and the task of screening work-related messages has become more time consuming. Davenport's study clearly indicated that the performance of knowledge workers was hindered by a lack of control over information flow and that e-mail was central to this problem. However, although we are aware that e-mail causes interruptions or, as Davenport noted, that we spend too much time handling e-mail, the question of how these situations affect our perception of whether we control our time well has never been answered.

Other research suggests that personality may affect the perceived control of time [7], possibly in all respects, including those specific to e-mail use. However, the mediating factors in the causal relationship between personality and the perceived control of time in e-mail use are not understood. Understanding what mediates this relationship would help to identify other variables that could change the relevant outcomes. The purpose of this study is thus to determine the constructs mediating the relationship between personality and perceived control of time.

Previous time management studies have primarily examined student samples, whereas we chose to conduct our study in an organizational setting. After all, time pressure is a problem that is more evident in the workplace than in student life. As e-mail is now a widely used application at work, a large sample questionnaire is feasible for empirically verifying the conceptual model.

The following section discusses the essence of each construct in the model and the relationships among them.

2. Research model and hypotheses

Existing research implies that people who are more proactive tend to have better perceived control of time. In a study of the relationship between procrastination and time management-related variables, Van Eerde [35] showed that procrastination results in poorer perceived control of time. The tendency to procrastinate is reflected in an individual's time management practices. Nonis, Teng, and Ford [28] studied the relationship between time management behavior and two styles of personality: polychronicity and monochronicity. Polychronicity refers to a preference for being involved in two or more tasks simultaneously, whereas monochronicity refers to the preference for concentrating on one activity at a time and establishing time management goals (e.g., planning, prioritization, and organization) to complete the task [17,24]. Goonetilleke and Luximon's [13] study concluded that under time limitations, people with a polychronic personality outperform those with a monochromic personality while undertaking multiple tasks simultaneously. This conclusion is related to greater time pressure because polychronic individuals perform or shift between a greater number of activities within a single time block. The above studies established the link between personality and perceived control of time.

According to time management theory, an individual's time management behavior directly affects his or her perception of time control [6]. The perceived control of time is the degree to which individuals believe that they can directly affect how their time is spent. We applied this theory to the context of e-mail use and adopted "time management behavior" as one of the mediating constructs. This approach led us to posit that personality affects the perceived control of time through the mediation of time management behavior.

Traditionally, time pressure-related problems are addressed in time management training. However, we believe that the issue of the perceived control of time in e-mail use cannot be solved solely by improvements in time management because this problem is specifically related to the use of e-mail tools. Farhoomand and Drury [10] affirmed that information overload and ineffectiveness

in processing information are related to the personal information-processing ability of knowledge workers. Thus, e-mail self-efficacy plays a role that is at least as important as (e-mail-specific) time management behavior and is identified as the other mediating construct. Because most organizations do not treat e-mail as an information system and do not devote appropriate attention to this system, the identification of this construct has a potential effect on firms' education and training portfolios.

Self-efficacy refers to an individual's judgment of his/her ability to perform certain tasks. Thus, e-mail self-efficacy refers to individuals' judgment of their ability to use e-mail in diverse situations. E-mail self-efficacy is related to—but not solely determined by—skill level. Rather, e-mail self-efficacy is measured by one's degree of confidence in using each e-mail function. In other words, the measurement of e-mail self-efficacy focuses on measuring the degree of confidence, and the degree of confidence is partially linked to the skill level. We hope that the investigation of these two constructs will enhance our understanding of their mediating effects and help us determine whether future research should focus on finding other mediating constructs.

The development of the research model is consistent with Locke's motivation hub model [26]. According to Locke's model, both self-established goals and self-efficacy mediate the relationship between personality and performance. Several empirical studies have investigated self-established goals and self-efficacy as mediators of the effects of personality [12,23]. These studies provide evidence that personality either fully or partially affects performance through self-established goals and self-efficacy.

Self-efficacy is a cognitive judgment regarding one's ability and is affected by one's emotional state, knowledge, and skills. However, Locke's original measurement of self-efficacy does not include variables such as knowledge and skills. He suggested that future research could fill this gap by generating a more comprehensive explanatory framework that includes these variables. In the area of time management, empirical evidence linking personality with various variables has begun to accumulate, but the relationship between personality and cognitive variables such as e-mail self-efficacy has not been studied. The current study represents one of the first attempts to empirically test this relationship.

The perceived control of time can refer both to e-mail use specifically and to work in general. The importance of the former is reinforced if the latter is largely or partially influenced by the former. In other words, it is of interest to test whether a lack of control over e-mail time results in a lack of control over work time. This line of reasoning and the possible mediators of the relationship between personality and perceived control of time are illustrated in Fig. 1 and are more fully discussed in the following subsections.

This study investigates whether proactive individuals demonstrate e-mail-specific time management behavior that reflects good time management practices and whether they tend to have higher average levels of e-mail self-efficacy, which increase their perception of being in control of their time.

2.1. E-mail-specific time management behavior as a mediator

Goal setting and time scheduling are dimensions of time management behavior, and a proactive personality is required to take the initiative to set goals and schedule time properly. In general, more proactive people demonstrate more desirable time management behavior because they are not easily constrained by their environment. Such people are also more inclined to take action to solve problems and to persist until meaningful change occurs.

The way in which people handle their time is highly correlated with individual characteristics [29], and people's attitudes toward
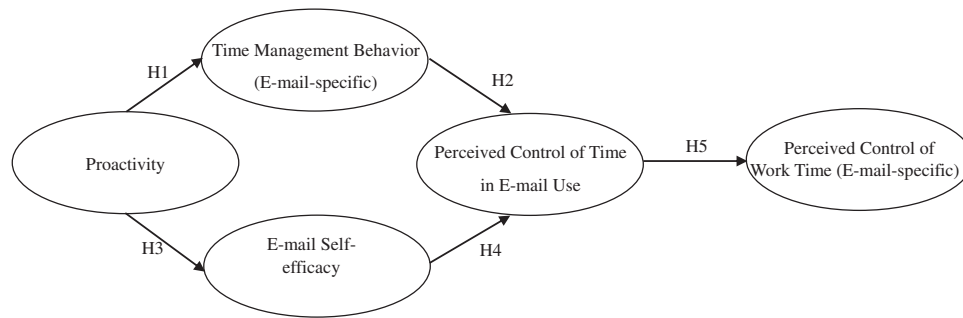
Fig. 1. Hypotheses and the proposed model.

time usage reflect their basic personality. In sum, proactivity influences a person's time management behavior, which may in turn affect work performance. An individual with a highly proactive personality may be more likely to meet the challenge of setting and achieving time management goals. Thus, the following hypothesis is proposed:

Hypothesis 1. An individual with a more proactive personality is more likely to display positive e-mail-specific time management behavior.

The type of time management behavior of interest is e-mail specific rather than time management behavior in a general sense. Extant research has found that people who excel at time management tend to have better perceived control of time [15]. Three arguments support this finding. First, as described above, the perception of controlling time naturally arises in the allocation of time through setting goals, scheduling, and organizing. Better time management also means less pressure. Second, social cognitive theory maintains that the modeling of one's vision leads to the establishment of action goals and the subsequent self-regulation of behavior to achieve those goals. Thus, setting goals helps one's self-control ability. Third, according to goal-setting theory, goals can affect the intensity, persistence, and direction of one's actions [27], which in turn leads to better control of time. This discussion leads to the following hypothesis:

Hypothesis 2. An individual's e-mail-specific time management behavior is positively related to his or her perceived control of time in e-mail use.

2.2. E-mail self-efficacy as a mediator

Another possible mediator of the relationship between proactivity and perceived control of time in e-mail use is e-mail self-efficacy. Proactive individuals may attempt to change their environment as well as identify and act on opportunities. Such individuals may also be more motivated to acquire knowledge, learn skills, and enhance the abilities that they lack to cope with their environment and thus further develop greater self-efficacy. Planned behavior theory holds that external variables (i.e., individual personality characteristics) affect the attitudes of individuals toward information systems (IS) usage. Specifically, people who are more proactive, curious, or adventurous have more positive attitudes toward IS, and such attitudes can in turn influence self-efficacy [34]. Frese and Fay [11] have also argued that the effect of proactivity on behavior and outcomes is mediated through domain-specific orientations, such as self-efficacy. Therefore, the following hypothesis is proposed:

Hypothesis 3. An individual with more proactive personality is more likely to show a higher level of e-mail self-efficacy.

If individuals believe that they possess the ability to cope with a situation, then they are more likely to succeed in controlling the

outcome. Their success is greater because greater self-efficacy makes it much easier for individuals to cope with anticipated changes, errors, or pressures. That is, greater perceived self-efficacy leads to the feeling of being more in control. In contrast, self-negation inevitably leads to failure. Consistent with this argument, the following hypothesis is proposed:

Hypothesis 4. An individual's e-mail self-efficacy is positively related to his or her perceived control of time in e-mail use.

2.3. The relationship between the two aspects of perceived control of time

The workplace of knowledge workers is a communication-intensive environment in which e-mail plays a central role. Knowledge workers tend to believe that they are proficient in e-mail use because it is generally regarded as an IS tool that does not require much IS skill or knowledge. However, knowledge workers do feel great time pressure resulting from e-mail use. It is thus important for organizations to ensure that knowledge workers are not overly pressured and that they feel in control of their e-mail use because better perceived control of time in e-mail use may help them to channel their work time to more important tasks, which may improve productivity and give workers a perceived sense that they have gained control of their work time.

The results of several studies have confirmed the positive relationship between self-efficacy and various performance indicators [21,22]. Perceived control of time, although not specifically studied in the contexts of these studies, is an indicator of performance. We thus posit that e-mail self-efficacy is indirectly related to knowledge workers' perception of time control at work through their perceived control of time in e-mail use. This reasoning leads to the following hypotheses:

Hypothesis 5. An individual's perceived control of time in e-mail use is positively related to his or her perceived control of work time.

2.4. Connection to existing theories

As discussed above, a general theory of time management existed prior to our study, although this theory was not specifically tied to the workplace. The existing general theory of time management consists of two parts, each supported by different streams of research. One research stream supports the relationship between personality and time management behavior, and the other stream supports the relationship between time management behavior and perceived control of time. We integrate these two approaches to establish a three-stage base causal link.

In the model shown in Fig. 1, both the constructs of "e-mail-specific time management behavior" and "e-mail self-efficacy" are expressly related to e-mail. If we remove the word "e-mail" and the "self-efficacy" part from the model, then it becomes a model that is supported by extant research for relating personality with time

management behavior and time management behavior with perceived time control. The theoretical building leading to Fig. 1 is sound because it is rooted in established general theory. However, our theory development does not end there. We revise the general model to fit the e-mail context and propose an additional mediating construct, "e-mail self-efficacy." The choice to measure personality in terms of proactivity and the focus on "e-mail-specific" time management behavior resulted from our consideration of the e-mail-specific context.

In the introduction, we noted that the degree of enjoyment found in social networking media is apparently greater than that found in e-mail use, as the former has more capacity to lead to a flow condition. Thus, when studying social networking or Internet surfing, the element of enjoyment must be included. However, e-mail use is seldom viewed as an enjoyable task in extant studies, and we can reasonably assume that the effect of enjoyment is minimal, especially in a workplace setting. To remain focused on our objectives, we do not consider enjoyment in our study. It is possible that some people do use e-mail as a form of social networking media; however, as long as these individuals represent a negligible percentage of the population, the effect is easily averaged out in a large sample. In addition, as richer social networking media are readily available, e-mail is definitely not a top choice for social networking.

3. Research method

The proposed research model based on the foregoing literature review contains five constructs. Data were collected to measure these five constructs to confirm the mediating processes and to test the fitness of the model. This section describes the measurement of each construct, presents example items, and describes the data collection procedure.

3.1. Measurement of the constructs

Proactivity. There are various approaches to personality assessment based on various streams of psychology research; examples include categorizing a person as Type A or Type B, labeling him or her as introverted or extroverted, or describing a person as more proactive or more reactive. Because extant studies on e-mail use have seldom considered personality as a predictor, it is challenging (if not impossible) to choose personality scales that are e-mail specific, as no existing e-mail studies offer any relevant insight. Many discrete personality descriptions have little relevance to the e-mail-specific context. For example, "aggressiveness" or "introversion" (or "extroversion") may not be as closely related to how a person manages e-mail or learns to use e-mail. People with introverted or extroverted personalities may be equally competent in time management. A person does not need to be aggressive to handle e-mail well.

A dichotomous approach, such as labeling subjects as proactive or reactive, appeared to be most relevant and would have been readily understood in the context of such studies. However, we aimed to assess the degree of each subject's proactivity in relation to his/her e-mail-specific time management behavior. Dividing subjects into proactive and reactive groups would have resulted in the loss of much information in the artificial bipartite process, potentially obscuring the true relationship. Preserving information content is crucial in identifying causal relationships; thus, we prefer to use an interval scale rather than a nominal scale variable to describe personality in a continuous dimension: "proactivity." This study adopted the proactive personality scale developed by Bateman and Crant (as cited in [3]) to assess subjects' proactivity; this unidimensional scale contains thirteen items. The Cronbach's alpha for this measure in our study is .87.

E-mail-specific time management behavior. Macan developed a time management behavior scale (TMB) that measures general time management behavior with three subscales: goal-setting tendency, time management mechanics, and preference for organization (as cited in [6]). To better capture time management behavior that is specific to e-mail use, we developed our own scale by revising (rewording, deleting or adding) Macan's items. High scores on the scale indicate that individuals apply the time management methods in question more frequently.

E-mail self-efficacy. The measurement of e-mail self-efficacy assesses respondents' perceptions of their familiarity with each e-mail function, but it is not an absolute measurement of ability. To maximize the predictive power of any measurement, the measurement scale should be customized to the domain of interest. There are many studies of computer or Internet self-efficacy [16,33], but no studies have specifically examined e-mail self-efficacy. There are countless e-mail functions, but not every function is likely to be crucial to the e-mail usage of knowledge workers. Thus, in designing the e-mail self-efficacy measurement items, we first conducted a focus group to collect in-depth information on how knowledge workers process and file e-mails and on their overall e-mail usage behavior. Scale items were then developed based on the computer self-efficacy scale, and the major e-mail functions were determined by the focus group findings. In other words, the e-mail functions identified by the focus group study served as the targets in the self-efficacy assessment.

Perceived control of time. We applied Macan's scale of the perceived control of time to the contexts of e-mail use and general work [5]. The constructs differ because they refer to dissimilar contexts. Mathematically, "Control of Time in E-mail Use" is a component of "Control of Work Time." However, individuals' perceptions may not match the mathematical model. For example, if a respondent feels that he/she generally handles work tasks quite well and does not feel that time is in short supply but does feels that he/she needs to allocate a major portion of work time to maintain pace with e-mail tasks, then the answers to similar items for the two constructs of "Perceived Control of Time in E-mail Use" and "Perceived Control of Work Time" would differ. The Cronbach's alphas for the two constructs, each of which is measured by five items, were .83 and .78, respectively. Because no additions or deletions of Macan's items were made, we did not conduct an exploratory factor analysis of the structure of the construct. In the questionnaire, the respondents were also asked to estimate the time that they spent on e-mail tasks. The results revealed a negative correlation ($r = -.27$, $p < .01$) between the perceived control of time and estimated time spent on e-mail tasks, which confirms the criterion validity of the measurement of perceived control of time.

Control variables. The model contains four control variables: position, gender, age, and e-mail volume. The first variable is included because senior managers have been found to suffer more problems related to e-mail overload than other employees do. Gender and age were included because other studies have found them to be related to technology usage behavior. Finally, e-mail volume is regarded as an important variable affecting e-mail users' perceived control of time. These control variables are not variables of particular interest, but they were selected because they could affect the observation of the primary relationships examined in the study. Thus, in the analysis, the correlations of the control variables with other variables were calculated to identify and control for their potential effects.

3.1.1. Example items for each construct

The respondents rated each item statement on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Some examples of the measurement items are listed as follows.

E-mail-specific time management behavior

- I prioritize my incoming and outgoing e-mails as a habit.
- I always finish my e-mail tasks within a reasonable amount of time.
- The e-mail messages that I write are usually brief.

E-mail self-efficacy

- I am confident in using the address book function, for example, when establishing a contact group.
- I am confident in setting e-mail rules to automatically move incoming e-mails to the appropriate folder.
- I am confident in archiving my e-mail efficiently, for example, when using the compressing function.

Perceived control of time in e-mail use

- I feel that I am in control of the time I spend using e-mail.
- I find it difficult to maintain pace with e-mail tasks (reverse-tone statement).
- I underestimate the time that it takes to handle e-mail (reverse-tone statement).

Perceived control of work time

- I feel that I am in control of my work time.
- I underestimate the time that it would take to accomplish tasks.
- I must spend a great deal of time on unimportant tasks.

Proactivity

- I am constantly seeking new ways to improve my life.
- I feel driven to make a difference in my community and perhaps in the world.

3.2. Sample and data collection procedure

Data were collected in two waves. In the first wave of data collection, to refine the measurement scales for e-mail-specific time management behavior and e-mail self-efficacy, we collaborated with four companies and attained a high response rate through telephone and e-mail follow-up. In the second wave of data collection, to cross-validate the internal consistency of the revised scales, we collaborated with the human resources department of a multinational computer and electronic home appliance corporation headquartered in Taiwan. Because a list of staff was not available to us, the questionnaires were distributed through the company's human resources department. Potential respondents were contacted through internal announcements, such as newsletters and postings. No incentives were offered for either wave, and participation was voluntary. Although there were no concerns regarding biases introduced by incentives, self-selection bias remains a concern. To eliminate the possibility of self-selection bias, the profiles of the subjects who completed the questionnaires were compared with the employee profiles provided by the human resource department, and no discrepancies were found. Therefore, the risk of self-selection bias is low. Confirmatory factor analysis was conducted to assess the quality of the factor structure. The convergent and discriminant validity were also examined before testing the hypotheses.

4. Analysis and results

This section presents a description of the sample and the results of the reliability, validity, and hypothesis testing.

Two hundred questionnaires were sent to reach the first sample, and 165 questionnaires were returned, representing a response rate of 82.5%. All of the responses were valid. Fifty-three percent of the respondents were male, and 47% were female. The industry categories included manufacturing (24%), finance (31%), service (16%), and information (29%).

The second sample produced 251 valid responses, yielding an 83.6% response rate. To test for non-response bias, we used t-tests to compare the profile of the earlier and later respondents (those responding after the first batch of respondents), such as whether they held a managerial position, their number of years of experience, and their gender. The two groups of respondents did not differ in any of these variables (at a 10% confidence interval), and it was thus inferred that the population appeared to be well represented by the sample.

Sixty-four percent of the respondents in the second sample were male, and 36% were female; moreover, 61% were married, and 39% were single. The mean age was 35 years, and 35% of the respondents held a managerial position. The average years of work experience and e-mail usage history were 11–15 and 6–10 years, respectively. The fact that the respondents ranged from executives to administrative personnel reflects the wide range of knowledge work. The nature of their work spanned R&D (40%), finance (7%), administration (21%), engineering/manufacturing (25%), and production/sales/purchasing/quality control (7%).

4.1. Scale refinement

The measurements of the items adopted from a time management behavior scale and those adopted from a software self-efficacy scale do not overlap because the scales are unrelated. Therefore, the two groups of items were individually subjected to exploratory factor analysis rather than being grouped together. The first sample was used for this purpose. Exploratory factor analysis provided the basis for item elimination.

As Cronbach's alpha assesses the reliability of the measurement items of a construct and as different constructs are not expected to show high reliability because they are incongruent in nature, the Cronbach's alphas are calculated separately for the various constructs. Consequently, each construct, if not further extracted to factors, has a corresponding Cronbach's alpha value. Each of the constructs of time management behavior and e-mail self-efficacy in our paper has two factors. Each factor also has a corresponding Cronbach's alpha value. Hence, a total of seven Cronbach's alpha values emerged.

4.1.1. Refinement of the e-mail-specific time management behavior scale

Eleven items were pretested with 165 knowledge workers in a variety of industries. Exploratory factor analysis was then used to examine the factor structure of the construct. Two factors with eigenvalues of greater than 1 emerged, which together explained 64.7% of the total variance. The first factor was labeled "habit factor" and was used to assess how the respondents established goals and scheduled their time regarding e-mail use. The second factor was labeled "judgment factor" and was used to assess the e-mail writing effort and media selection considerations of the respondents. The Cronbach's alphas for these factors were .76 and .79, respectively, which exceed the recommended criterion of .70, indicating that the items reliably measure each factor dimension. These two factors differ from Macan's time management behavior scale. This difference is expected because the items in the current study are specific to e-mail use, whereas those used in Macan's scale concern time management in a more general sense.

4.1.2. Refinement of the e-mail self-efficacy scale

Each item in the self-efficacy scale assessed the extent to which the respondents believed that they were capable of using specific e-mail functions. Exploratory factor analysis found support for two e-mail self-efficacy factors that explained 63.9% of the total variance: "basic efficacy" and "advanced efficacy." Their respective Cronbach's alphas of .81 and .72 suggest an acceptable level of reliability.

4.2. Model validation analysis

A two-step process was adopted to validate the research model, and the second sample was used for this purpose. The aims of these two steps were to test and confirm the measurement model and structure model. The measurement model was tested using confirmatory factor analysis to evaluate the reliability and validity of the two measurement constructs of e-mail-specific time management behavior and e-mail self-efficacy, and a structure model was used to evaluate the fit of the overall model.

4.2.1. Measurement model

The confirmatory factor analysis was conducted using AMOS software. To evaluate the fit of the models, the ratio of the chi-square to the degrees of freedom (χ^2/df), the goodness-of-fit index (GFI), the incremental fit index (IFI), and the normed fit index (NFI) were employed. The value of χ^2/df should be less than 3, and a good fit is normally assumed when the GFI, IFI, and NFI are close to 1 (for example, greater than .9). The results suggest a good fit for both e-mail-specific time management behavior and e-mail self-efficacy. The value of χ^2/df for basic efficacy in our study is 1.93, which shows that the measurement model is acceptable. Unlike χ^2, which has a statistically meaningful objective criterion, objective criteria for model fit based on GFI and NFI do not exist, although the recommended value is as close to 1 as possible. As shown below, the GFI, IFI, and NFI values are all greater than .9, except the GFI and NFI for basic efficacy, which are .88 and .86, respectively. Whether GFI = .88 and NFI = .86 are close enough to 1 when they are 0.9 is a subjective judgment.

Habit:　　　　　　　　χ^2/df = 1.76, GFI = .98, IFI = .97, NFI = .95.
Judgment:　　　　　　χ^2/df = 1.65, GFI = .93, IFI = .91, NFI = .95.
Basic efficacy:　　　　χ^2/df = 1.93, GFI = .88, IFI = .91, NFI = .86.
Advanced efficacy:　　χ^2/df = 1.72, GFI = .95, IFI = .92, NFI = .93.

The construct reliability of each construct was assessed by computing the composite reliability and average variance extracted. The convergent validity was assessed by testing whether the factor loadings were significant, and the discriminant validity was calculated by a chi-squared difference test. The composite reliability values for our data ranged from .83 to .89,

which were above the threshold of .6. In addition, the average variance extracted ranged from .51 to .56, all exceeding the recommended cut-off levels of .5. All factor loadings of the factors extracted from the e-mail-specific time management behavior and e-mail self-efficacy constructs were significant ($t > 2.35$, $p < .01$). The results of the chi-squared difference tests ranged from 15.93 to 69.98 ($\Delta\chi^2 > 6.63$, $p < .01$), suggesting that the constructs are distinct and show discriminant validity.

4.2.2. Structure model

Structural equation modeling (SEM) is the most efficient estimation method for examining a system of multiple regression equations simultaneously. We thus assessed the proposed model using SEM with maximum likelihood estimation. All calculations were based on the covariance matrix.

SEM analysis software facilitates model adjustment. A model can be adjusted by the principle of increment or decrement to achieve better model fit or to improve the significance level of causal relationships. In this study, the proposed fully mediated model did not attain a good model fit in the initial analysis. Therefore, we adopted the principle of increment to modify the proposed model, aiming to improve the overall model fit. As a result, two additional relationships were added to the fully mediated model, and the model became partially mediated. The final partially mediated model has a better model fit than the previous fully mediated model. The results indicate that the partially mediated model (χ^2 (4, N = 251) = 12.93; GFI = .976; CFI = .962; IFI = .965; RMSEA = .077) has a better fit (χ^2 (5) = 47.86, $p < .01$) than the fully mediated model (χ^2 (9, N = 251) = 60.79; GFI = .935; CFI = .823; IFI = .84; RMSEA = .10). In the model, the direct links from proactivity to perceived control of e-mail use (β = .02, $p > .1$) and from e-mail-specific time management behavior to perceived control of work time (β = .09, $p > .05$) were not statistically significant. We thus compared the model with a model that excluded these two insignificant paths (shown in Fig. 2). The results indicated that the two models were not significantly different ($\Delta\chi^2$ (2) = 4.05, $p > .05$). We thus preserved the more parsimonious model (with the insignificant paths deleted, as shown in Fig. 2) as the final model and used it to examine the hypotheses. This model fitted the data well (χ^2 (6, N = 251) = 16.98; GFI = .985; CFI = .964; IFI = .967; RMSEA = .068). All of the standardized path coefficients, as shown in Fig. 2, were statistically significant (either at $p < .01$ or $p < .05$) in the predicted directions. Therefore, Hypotheses 1, 2, 3, 4 and 5 were all supported. Note that in Fig. 2, the path from e-mail self-efficacy to e-mail-specific time management behavior was statistically significant (β = .23, $p < .01$).

As Table 1 shows, the effects of the control variables (i.e., e-mail volume, work position, gender, and age) are largely controlled because the correlations between them and two dependent variables are mostly statistically insignificant (r = −.06, .1, .007, −.11, .14*, −.02, .13, .02). For the one case in which the correlation
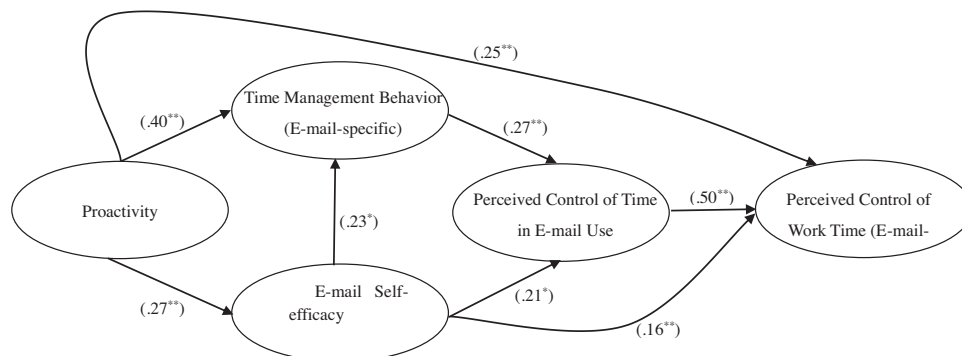

Fig. 2. Standardized path coefficients in the final model. *$p < .05$; **$p < .01$.

Table 1
Means, standard deviations, and correlations among the variables.

Variable	1	2	3	4	5	6	7	8	9
Proactivity									
Time Mgmt	.28**								
Self-efficacy	.30**	.22**							
Time Ctrl (e-mail)	.25**	.25**	.20*						
Time Ctrl (work)	.30**	−.04	.27**	.48**					
E-mail volume	.09	−.18**	.21**	−.06	.14*				
7. Work position	−.13*	−.01	.01	.10	−.02	−.24**			
8. Gender	−.15*	−.05	.04	.07	.13	.01	.27**		
9. Age	.15*	.07	−.12	−.11	.02	.12*	−.48**	.86**	–
Mean	3.54	3.35	3.54	3.25	3.31	12.05	–	–	3.19
S.D.	.41	.42	.66	.68	.56	6.50	–	–	1.04

Note.
Variable #7 (manager/non-manager) and #8 (male/female) are nominal scales.
Variable #9 is an interval scale, and the value of 3.19 corresponds ages 31–40.
* $p < .05$.
** $p < .01$.

is significant ($r = .14^*$; $p < .05$), which is the correlation between e-mail volume and perceived control of work time, interesting implications arise. The fact that the e-mail volume is not correlated with the perceived control of time in e-mail use but is correlated with the perceived control of work time implies that high e-mail volume most likely does not decrease the perception of being in control of e-mail use, although it inevitably leads to not being in control of work time.

The mediating effects expressed in the model were further confirmed by the Sobel test. The analysis showed that proactivity had a significant indirect association with the perceived control of time in e-mail use, through e-mail-specific time management behavior ($z = 2.14$, $p < .05$) and e-mail self-efficacy ($z = 2.01$, $p < .05$). In addition, e-mail-specific time management behavior ($z = 2.61$, $p < .01$) and e-mail self-efficacy ($z = 2.29$, $p < .05$) had a significant indirect association with the perceived control of work time, through the perceived control of time in e-mail use.

5. Discussion

The causal links confirmed in our studies shed light on the importance of two mediating constructs: e-mail self-efficacy and time management behavior specific to e-mail use. The results show that knowledge workers with more proactive personalities had better perceived control of time in e-mail use and perceived control over their work time because of their greater e-mail self-efficacy and more effective e-mail-specific time management behavior. These findings are consistent with the proactive behavior integrative model proposed by Crant [8], in which proactive behavior (e.g., general action and context-specific behavior) mediates the relationship between individual differences (e.g., proactive personality and personal initiative) and outcomes (e.g., feelings of personal control and job performance). In Crant's model, the mediating construct is proactive behavior, whereas in the current study, e-mail-specific time management behavior and e-mail self-efficacy are the mediating constructs. This study thus contributes to the literature by identifying and confirming these partially mediating context-specific constructs.

Whereas people with more proactive personalities demonstrate more desirable time management behavior in e-mail use and have higher levels of e-mail self-efficacy, people whose personalities are not characterized as proactive need management interventions to help them acquire desirable behavior and skills. Alas, most organizations regard e-mail skills as being so basic that employees should already have learned them or should be able to acquire them on their own. Certainly, personality is not easily altered, but our stance is that all people can be helped. With proper management interventions, more desirable time management

behavior in e-mail use and higher self-efficacy are possible, even for people who are less proactive.

The results further demonstrate that in addition to its association with the perceived control of time in e-mail use through e-mail-specific time management behavior and e-mail self-efficacy, proactivity is directly associated with the perceived control of work time. Individuals with more proactive personalities often explore information and opportunities to improve their situations rather than passively waiting for opportunities. This quality is displayed not only in e-mail use but also in many other areas. This tendency enables one to achieve a desirable outcome, such as better perceived control of work time.

We also found that e-mail-specific time management behavior is indirectly linked to the perceived control of work time through the perceived control of time in e-mail use. A possible explanation for this finding is that most knowledge workers are ruled by e-mail, although they may think otherwise [18], and thus, gaining control over work time also depends on gaining control of the time spent on e-mail use. The finding that knowledge workers' perceived control of time in e-mail use further influences their overall perceived control of work time accentuates the influence of e-mail in the workplace and effectively demonstrates the practical significance of this research.

Our findings suggest that e-mail self-efficacy is directly associated with the perceived control of work time, which is consistent with the findings of other research regarding a positive relationship between application-specific computer self-efficacy and performance [20]. We also found that e-mail self-efficacy positively influences time management behaviors specific to e-mail management ($\beta = .23$, $p < .01$). Perhaps the confidence that is associated with greater e-mail self-efficacy leads individuals to aim higher regarding e-mail-specific time management behavior goals and to act upon them.

An important practical implication of these findings is the possibility of enhancing the perceived control of time by improving knowledge workers' e-mail self-efficacy and e-mail-specific time management behavior. The perceived control of time is intuitively closely related to productivity because time is an important element of productivity. Thus, although it is difficult to assess the degree of influence of these two mediating constructs, sensible organizations should consider taking actions to enhance the e-mail time management behavior and e-mail self-efficacy of knowledge workers.

If one regards e-mail as an information system that is not very different from other information systems, then our finding regarding the importance of e-mail self-efficacy would not be surprising. However, if one regards e-mail as a routine office task and views its influence as merely a result of time management,

then our research result is quite surprising because e-mail self-efficacy apparently plays the central role in the mediating effect. Organizations are so accustomed to the wide adoption of e-mail that they treat e-mail as an ordinary office tool rather than an information system. Our study draws attention to the effect of e-mail use on knowledge workers. E-mail is commonly regarded as a tool that requires few skills, and organizations tend to believe that their employees can acquire necessary knowledge on their own. In this paper, we successfully show that e-mail is an information system that affects knowledge workers as significantly as other information systems, if not more profoundly. If skills in other information systems are crucial, then the skills for e-mail use are also important. Given the frequent administrative indifference toward e-mail self-efficacy, the results of our research provide valuable evidence that this mindset must change, because e-mail use may require formal training and education, similar to all other information systems [19,30].

As to what mode of training and education is most effective, further investigations are required. In a study anchored in web-based computer software training [14], it is concluded that self-regulated learning strategies, in which learners are dominant, lead to better learning performance. The study appears to suggest that a self-regulated web-based e-mail knowledge platform is an optimal choice. However, more studies are necessary to determine the most appropriate approach.

In conclusion, the findings of this study contribute to theory building concerning the effect of e-mail use—a key Internet application—on knowledge workers in two ways. First, this study identified an appropriate "proactivity" variable for measuring personality in an e-mail-relevant context, among the multitudes of potential variables that could characterize personality. Second, this study identified two important mediating constructs and addressed the "how" and "why" aspects of the relationship between personality and perceived control of time in e-mail use. These two mediating constructs are e-mail-specific time management behavior and e-mail self-efficacy, with the latter offering greater explanatory insights. First of all, the presence of this additional mediator, which was absent in the existing general theory, has been confirmed; furthermore, this construct serves an important cause of the other mediating construct, e-mail specific time management behavior.

5.1. Limitations and future research

First, the samples used in this study comprised knowledge workers in the high-tech sector. Although studies of knowledge workers in other industries are unlikely to generate different conclusions, the generalizability of our findings to other sectors requires further confirmation. Future research could thus fit the model with data collected from other industries of interest. Our finding also serves as a beacon for future research, suggesting that one approach similar issues from the description of personality along the proactive/reaction continuous dimension. However, cumulative studies are necessary before we can confirm that this type of personality measurement is the most relevant to e-mail studies.

Another point worth mentioning is that the data were collected in Taiwan. Although we do not think that geographical considerations have biased our interpretation, future research using samples from other regions would provide direct evidence of the generalizability of our findings across cultures.

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