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Review article

Enhancing the use of e-mail in scientific research and in the academy

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ABSTRACT

From professors overwhelmed by anxiety-driven e-mails from students, through faculty and administrative staff wasting valued time on e-mail minutia, misuse of electronic mail in the academy has become ubiquitous. After a brief overview of the unique features of e-mail communication, this study provides guidelines to plan new educational activities on purposeful utilization of electronic mail in university and research centres of the digital era. The overall aim is to prioritize scholarly deep work by focusing on teaching and research work, freeing working time wasted on unproductive use of e-mail.

1. Introduction

Plentiful research has been devoted to the impact of the internet on scientific research. As early as of 2003, Nentwich argued that the internet does not change only the distribution of knowledge but, most importantly, also the very process of knowledge production [1].

Over the past decade publishing and retrieving scientific articles have become as an entirely "digitalized" process, namely an online activity involving internet access to digital (electronic) files generally made available in portable document and hypertext markup language (PDF and HTML) formats.

Today's students find it hard to believe that until the late 1990s, publishing a scientific article started by mailing an envelope embedding three or even five copies of a written manuscript addressed to the journal's editor. Current scientific articles are "hypertexts" realizing Bush's 1945 insight on forthcoming texts and books in which references to other text would be present as "hyperlinks" that the reader can immediately access [2].

The internet, in addition, enables the shift to open science [3] in which scientific articles are immediately published as freely accessible preprints inviting scholarly feedback [4], and subsequently as peer-reviewed articles, typically under a license such as the one (Creative Commons) "inviting everyone to adopt and reuse its content" [3].

Less research attention has been devoted to study the impact of electronic mail on scientific research. For instance, in 2008 Hanson-Baldouf and Weiss found that "studies related to e-mail use in the specific context of faculty-student communication and enhanced learning are limited and warrant further investigation" [5].

Five years later a study on the use of e-mail in student–faculty interaction in countries as diverse as Germany, Saudi Arabia, and Japan found a "lack of pragmatic competence… in all three groups of students, independent of the proficiency level and seniority" [6].

Today, misuse of electronic mail in the academy has become ubiquitous. Following a brief Editorial on the same topic [7], this study provides insight and guidelines to plan new educational activities on purposeful utilization of electronic mail in university and research centres of the digital era. The overall aim is to prioritize scholarly deep work by focusing again on teaching and research work, freeing faculty's and student's time otherwise wasted on unproductive and chaotic use of e-mail.

2. The unique features of e-mail communication

E-mail is a communication technology that combines flexibility and almost instantaneous exchange of information across a digital network of computers (servers) which today is basically global [8]. In 1978, aged 14-years, V. A. Shiva Ayyadurai, created new electronic mail software, embedding the functions of every subsequent e-mail software "application": Inbox, the Memo (To, From, Date, Subject, Cc, Bcc), Outbox, Address Book, Trash, Folders, Attachments, and more [9]. His aim was to replace with e-mail the pneumatic post system used until then to deliver letters among office workers of a small medical college.

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In an interesting recent account on how "experts" continued to wrongly predict the end of e-mail since its inception, Shiva Ayyadurai has explained how they "keep confusing e-mail with other media: chat, online bulletin boards, texting, instant messaging, blogs, etc. But, when one truly looks at the origin of e-mail: the interoffice mail system, which was the engine of communications for businesses, it becomes clear, that as long businesses, big and small, are around, e-mail will be here for a long, long time" [10].

2.1. Instantly, across the globe

Contrary to conventional mail, with electronic mail exchanged by networked computers no "atoms" [11] but rather "bits" are transferred, using the simple mail transfer protocol (SMTP) published by Postel in 1982 "to transfer mail reliably and efficiently" [12].

Enabling almost instantaneous communication across borders, e-mail fosters collaboration between scholars and researchers offering unprecedented possibilities. For example, using the aforementioned "attachment" function of e-mail software, researchers based in different continents can exchange the revised versions of a joint scientific paper in matter of seconds. A process that by conventional post would take several days or weeks can now be completed in a few hours.

2.2. Collaboration enabler

In a 2007 study devoted to the internet as a tool to promote collaboration and productivity in the scientific community in South Africa, scholars found that the use of electronic mail was "the primary technology of collaboration for communication between individuals and teams of scientists and scholars", even though "little evidence" was found that the use of the new information and communication technologies had any large impact on productivity [13].

On the contrary, a more recent study based on data concerning more than 1,400 scientists from five academic disciplines (astronomy, chemistry, computer science, economics, and psychology) and seven European countries (Denmark, Germany, Ireland, Italy, the Netherlands, Switzerland and Great Britain) clearly pointed to a positive correlation between internet use and research productivity [14].

A 2009 study on the impact of information technology on the productivity of almost 4,000 research-active life scientists from more than 400 institutions based in the USA over a 25-year period focused on two early IT innovations (BITNET, a network of American universities, and DNS, the naming system by which internet domain names are concerted into internet protocol addresses) [15]. Results were revealing.

Information technology enhances both the overall research output and collaboration, via an increase in the number of collaborations, and it does so even more for early-to-mid-career stage scientists who largely benefited from the new technology in terms of research quantity, quality and collaboration networks [15].

3. From enhanced to worsened productivity

The internet has changed and greatly enhanced the practice of scholarly communication and collaboration [1, 4]. Teaching, too, has been greatly affected with new tools that expanded the possibility to interact between the educator and the classroom, and amid trainees too [16]. Along with plentiful new benefits, however, a number of problems and negative consequences quickly emerged.

3.1. Interruption enabler

The negative effects of e-mail misuse on well-being and productivity were soon documented after generalized adoption in all sort of working environments. In the early 2000s the study of e-mail utilization at a service company in Britain discovered that e-mail is less disruptive than the telephone, with the recovery time from an e-mail interruption being 64 s (much less than the 15 min recovery time for telephone calls), but since employees checked their mailbox for new e-mails every 5 min and responded immediately (within 6 s), "with users receiving more and more emails the accumulative effect is still likely to be significant" [17].

Frequent interruptions at work (not to be confused with necessary regular breaks from work after which one returns energized and ready to resume work) are well known to significantly damage productivity, particularly in the case of knowledge workers [18]. Furthermore, the study reported a misuse of e-mail later to become ubiquitous across the world: several e-mails received lacked personal relevance as they were sent to all employees using the "send-to-all" function of the e-mail software, while the message received "was often only useful to one or two" [17].

3.2. Work stressor

Seven years later another team in Great Britain described e-mail as an inbuilt "work stressor" contributing to work overload, with potential negative effects on social relationships and productivity [19]. Underlining how it was "time to include e-mail communication skills as a key part of the interpersonal skills training for all managers", the authors noted:

> «At Thomas Edison's Ontario home, the birthplace of the telephone, there is a small plaque depicting instructions to the users of the then new medium: how to speak, at what voice level and intonation, at what distance from the receiver, key phrases, etc. At the time these made a necessary manual; nowadays, one reads the notes with a wry smile: surely everyone knows what one can and can't do with a telephone? As we are at the onset of a world e-mail dominated epoch, we likewise could do with some user instructions, deployment conventions, and best practice. That may be no mean task.» [19].

The fact that checking e-mail less frequently reduces stress was shown by a 2015 experimental study [20]. By simply asking 124 adult information workers to check their e-mail three times a day, rather than an unlimited number of times per day, workers experienced significantly enhanced psychological stress, thereby demostrting how a simple change in how people approach their e-mail messages may significantly reduce the stress of a typical working day [20].

Limiting the number of times people checked their e-mail lessened tension during a particular important activity and lowered overall day-to-day stress. In turn, lower daily stress was associated with higher well-being, as assessed by a range of outcomes including hedonic and eudaimonic outcomes. I briefly remind that hedonia and eudaimonia are the complementary concepts under which the contents of well-being in psychology are organized – with hedonic contents involving feelings like pleasure, enjoyment, satisfaction, comfort and ease; and eudaimonic contents involving instead meaning, relevance to a broader context, personal growth, self-realization, ethics, quality, authenticity and autonomy [21]. Furthermore, lower stress was associated with other positive outcomes including higher mindfulness, self-perceived productivity, and sleep quality.

As shown by the recent management study reporting the outcomes of a survey of 639 employees from U.S. private firms as well as from universities, the mere employer expectation of work e-mail monitoring during nonwork hours is detrimental to the health and well-being of not only employees, but their family members as well [22].

4. Prioritizing deep work

Writing about time management of knowledge workers, Drucker, a renown management thinker noted how:

> «To be effective, every knowledge worker… needs to be able to dispose of time in fairly large chunks. To have dribs and drabs of time

at his disposal will not be sufficient even if the total is an impressive number of hours.» [23].

Accordingly, most scholarly activities such as writing, reading and thinking need to be carried out in prolonged periods of time without interruptions and distractions. The average American professor has been lately found to spend 61 h a week working (over 10 h per day during the workweek and just under 10 h on the two weekend days combined) [24]. Yet, while 17 percent of the workweek days was found to be dedicated to meetings and 13 percent to e-mails, only 3 percent of the workweek day was spent on research and 2 percent on manuscript writing.

How to provide scholars more uninterrupted time for thinking, writing, mentoring and teaching – what he has aptly called "deep work" [25] – has been lately proposed by Newport. In brief, universities and research centres should review the administrative duties of their professors and researchers, getting rid of all those "mainly serving to sustain bureaucratic self-regeneration" [26]; while a dedicated pool of assistants could rather support several professors to accomplish the truly needed administrative and service tasks [26].

5. Guidelines and recommendations

Since knowledge workers tend to organize their work very differently, I suggest a spectrum of possibilities to restore purposeful and creative use of e-mail in research and teaching. For example, for some people processing e-mail effectively means answering it the next day. For others, the best option will be to batch e-mail topics and answer them at a specific time.

Four guidelines will help towards the aforementioned objective which is now common to scholars in basically all countries in all research fields.

5.1. Clearing the mind

Working in an environment in which priorities are constantly changing, prior to writing and reading e-mails, scholars and students alike may wish clearing their mind following the method developed by Allen, a mangement consultant and thinker, to conduct knowledge work minimizing stress and anxiety while maximizing the number of purposeful tasks completed [27].

Allen discovered during the practice of management consultancy what cognitive science revealed several years later, namely that "the brain heavily relies on the environment to function as an external memory and a trigger for actions" [28].

Rather than checking e-mails an unlimited number of times per day, or start writing e-mails at unplanned moments of the day, Allen's method suggests to read and answer e-mails within a single and same context of the day in a state of mental control and in the psychological state of flow, which requires first and foremost to write down on paper or in a digital file all the things and tasks deserving attention for subsequent processing [27].

Many other options exist that allow people to put together a program that fits their working mode. Some are provided in the following so that readers can try them and, in case of success, implement them in their own way of working.

5.2. Processing e-mails

To avoid interruptions effective processing of e-mails separates the acts of reading and answering electronic missives. Merging Allen's ideas with the key principle of the approach of Forster to time management [29], – namely "to create a 'buffer' between the information and demands that are coming at you, and your response" [30] – McGuinness has lately identified several benefits of a thoughtful approach to e-mail processing in which yesterday's e-mails are processed today, in a single batch [30]:

- Deal with the manageable task of processing a finite number of e-mails, rather than an ever-expanding inbox.
- Avoid interruption from today's e-mails.
- Answer e-mails produced in a better state of mind in which one is less likely to take on unnecessary commitments by agreeing to something in order to get rid of the e-mail.

As mentioned above, for some people processing e-mails the day subsequent to their arrival will be optimal. Another option is batching e-mail topics and answering them at a specific time. One faculty member, for instance, answers all teaching-related emails on Tuesdays and Fridays in the afternoon, thereby reducing task switching as individual e-mails are about very different topics and require to mentally switch each time to a specific knowledge domain.

Effectively processing e-mails may also imply to avoid reading and answering e-mails in the early part of the working day, when the mind is ready for productive work during the most effective hours of the day. Rather to start the day by reading and aswering e-mails instead of working on research, a scholar could for instance set up a rule: never to read and answer e-mails before lunch.

5.3. Effective e-mails only

Usability was the principle that guided Shiva Ayyadurai when developing the first e-mail software in 1978:

> «I had better make e-mail really easy-to-use. This meant all those features had to be delivered through an easy-to-use user interface. At that time there was no mouse, just a keyboard. An easy-to-use interface meant simple menus, no need to type in commands or codes, ease of navigation, ability to quickly scan their incoming mail, etc.» [10].

By the same token, aware that effective communication is measured by what the message recipient understands and by her/his reaction to the message (feedback) [31], only useful and professional e-mails should be written and sent.

- **Short and clear subject.** The subject is important. Shorten and focus subject lines. A subject headline like "Molecular group absorption frequencies for betanin FTIR analysis" will be rephrased as "Betanin FTIR: absorption frequencies".
- **One topic, short, clear and proofread.** The scholar recipients of e-mails are extremely busy people. Write only purposeful e-mails containing information that is valuable to them, clearly written in form of a concise and proofread message text preferably dealing with one topic only.
- **Short, separated paragraphs.** Should the message require more than one or two sentences, these should be short and separated by blank lines, avoiding in any case capital and large size font.
- **Files shared online.** Avoid attachment of "heavy" files and the associated security risks, and use instead file sharing services [32].
- **Personal e-mails only.** E-mails valued by the recipient are only those personally addressed to her/him. Do not use "e-mail all", and refrain from using "reply all" as well.

5.4. Communicate and educate

It may be useful to communicate clearly and in advance one's e-mail policy. A scholar might wish for example to advise her network that she will not read or react to e-mails that list her as a co-recipient or contain a "to-do" that is not obvious in the header, or in the first five lines of text.

Similarly, the same academic may wish to post on her personal web page that she will neither read nor respond to random external questions sent via e-mail.

Training people to use e-mail more sparingly is also important. A scholar could teach people from her network with whom she meets regularly to avoid sending "in-between mails", telling them instead to bring those topic to the subsequent regular meeting. Similarly, in educating recipients to use e-mail more sparingly, it is important to answer e-mails more slowly (for example, the subsequent day), and then again not during the most productive hours of the day.

When communicating with students concerning lecture topics, exams, laboratory work and excercises, a faculty member might wish to refrain from using e-mails and instead answering questions publicly during lectures or stay after a lecture until all questions have been answered.

6. Outlook and conclusions

Ending misuse of the precious e-mail communication technology in the academy and in research centres requires dedicated education of students and scholars, whatever be their own field or specialization, within a unified cultural context [33]. Becoming acquainted with advanced time management [27, 29, 30] and communication pragmatics [31], students will remedy today's e-mail misuse that leads professors to be overwhelmed by anxiety-driven e-mails [5, 6]; and scholars to waste their valued time on administrative minutia repeatedly sent via e-mail during the workweek.

Entering the 21st century third decade, universities and research centres reformed by managers literate in today's management theory [25, 27, 33] will focus again onto advanced teaching and research [25, 26], prioritizing scholarly deep work, ending the poor use of e-mail by students, scholars and administrative staff.

This study contributes by identifying selected recommendations to educate users of electronic mail in the academic community on healthy and productive utilization of e-mail based on over two decades of scholarly research in the field. Rather than suggesting one way to deal with the issue, and aware that knowledge workers tend to organize their work very differently, it proposes a spectrum of possible solutions concerning the optimal use of the key scholarly communication technology in the internet era.

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