

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

Mario Pagliaro

Istituto per lo Studio dei Materiali Nanostrutturati, CNR, Italy

E-mail mario.pagliaro@cnr.it, Website: www.qualitas1998.net

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 insight and guidelines to plan new educational activities on healthy and productive utilization of e-mail in the academy 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.

Keywords: e-mail, scientific productivity, internet, digital era

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]

Since over a decade publishing and retrieving scientific articles is an entirely “digitalized” process, namely an online activity involving the 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 first 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, even though the use of e-mail by a pioneering community of scholars goes back to the mid 1970s, long before the advent of the World Wide Web. For instance, in 2008 Hanson-Baldouf and Weiss were finding 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 the healthy and productive utilization of e-mail in the academy 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 transmission of information to one or multiple recipients across a computer network which today is basically global.^[8] In 1978, aged 14-years, V. A. Shiva Ayyadurai, invented the 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 in New Jersey’s Newark.

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, on-line 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” (to use Negroponte’s difference between bits comprising digital information and atoms making up physical objects)^[11] are transferred, but only “bits” sort out by the simple mail transfer protocol (SMTP) created 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, a scholar can send the draft of a scientific article to a co-worker based in another continent. Feedback that once took weeks to be received via the national postal service, now could be obtained in hours or days.

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 Greta Britain) clearly pointed to a positive correlation between internet use and research productivity.^[14]

In 2009, a study correlated a large random sample of 3,771 research-active life scientists from 430 U.S. institutions with a dataset combining information on the diffusion of two early innovations in information technology from 1969 to 1993:^[15] BITNET (a U.S. network of universities comparable to the internet), and DNS (the hierarchical and decentralized naming system by which internet domain names are located and translated into internet protocol addresses). Results were revealing.

The most notable effects of the new information technology (IT) was found on collaboration, as shown by the increase in the number of co-authors observed since the 1980s. However, whereas late-career stage scientists did not benefit from the adoption of IT by their institutions, early-to-mid-career stage scientists *greatly* benefited from the new technology in terms of research quantity, quality and collaboration networks. Furthermore, IT was found to act as “an equalizing force”^[15] increasing more the productivity of scientists at mid- and lower-tier institutions, and enabling faculty at said institutions to access to colleagues and resources at top tier universities and research centres.

3. From enhanced to worsened productivity

Since 1993 progress in the uptake of rapidly advancing IT has been dramatic, changing the practice of research in academia,^[1,4] and also that of teaching and learning.^[16] Access to the internet and to the e-mail became ubiquitous. Along with plentiful new benefits, 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 have been well documented since the early 2000s. In 2001, a study at a service company in Great Britain surprisingly reported that “e-mail messages do have some disruptive effect by interrupting the user - more than is generally assumed”.^[17] Some 70% of e-mails received, the scholars found, were viewed within 6 seconds, “quicker than letting the phone ring three times”.

Only a very small minority of employees, the scholars found, would postpone reading e-mail. The majority of employees enabled such interruptions every 5 minutes. Frequent interruptions at work (not to be confused with necessary regular breaks from work after which returning 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, namely that many of the e-mail messages received were not really relevant to employees because they mostly resulted from an e-mail sent to all employees using the “send-to-all” function of the e-mail software, when 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 aimed at investigating how the frequency of checking e-mail affects well-being.^[20] During one week in which 124 adults were asked to check their e-mail three times a day, they experienced low daily stress and experienced higher well-being on a diverse range of well-being outcomes. During another week in which participants could check their e-mail an unlimited number of times per day, they experienced significantly enhanced psychological stress.^[20]

Specifically, the team found that by 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 (*i.e.*, affect, comfort, painlessness and ease) and eudaimonic outcomes (*i.e.*, meaning to a broader context, self-realization, quality and authenticity). Furthermore, lower stress was associated with other positive outcomes including higher mindfulness, self-perceived productivity, and sleep quality.

I briefly remind that hedonia and eudaimonia are complementary psychological functions with both hedonic and eudaimonic variables having an important impact on well-being.^[21]

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

Both scholars and students need long periods of time to creatively advance research ideas, solve problems, study, write and review research articles and research projects. In the words of Drucker, a renowned management thinker:

«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]

Most scholarly activities need quiet time, without the interruption of phone calls, e-mails and meetings, namely the digital distraction worsened by onerous administrative burdens for which, for example, a 2014 study of faculty time-use carried out at a U.S. university found that the average professor spent 61 hours a week working (over 10 hours per day during the workweek and just under 10 hours 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 and teaching -- what he has aptly called “deep work”^[25] -- has been lately proposed by Newport. In brief, universities willing to prioritize again research and teaching will first carefully re-examine which administrative and service activities are truly worthwhile, getting rid of all those “mainly serving to sustain bureaucratic self-regeneration”,^[26] and then will provide faculty with support from a dedicated pool of assistants helping several professors to accomplish administrative and service tasks.^[26]

5. Guidelines and recommendations

Actionable advice to restore healthy and productive use of e-mail in the academy requires *i*) clearing the mind at work, *ii*) effectively processing e-mails, *iii*) writing effective e-mails only, and *iv*) communicate and educate.

Aware that knowledge workers tend to organize their work very differently, rather than suggesting one option only, I suggest a spectrum of possibilities. For instance, 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.

5.1 Clearing the mind

Clearing out unnecessary mental clutter caused by trying to keep track of all work commitments has been conceived and taught by Allen, starting in the late 1980s. Learning from his youth in which he was taught how to achieve the “ready state of the martial artist - a mind like water”,^[27] Allen developed a simple yet highly effective system for managing a person’s workload which involved clearing the mind by writing down all planned (and unfinished) tasks and projects, and then breaking them into “actionable” written work items.

This simple gesture of writing down planned tasks (recording them externally) moves them out of the mind and allows the mind to focus attention on taking action on tasks, instead of recalling them. This achieves “a condition of working, doing, and being in which the mind is clear”.^[27]

In brief, with his “focus on organizing tasks into actionable external memories, and on opportunistic, situation-dependent execution”,^[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]

Dealing with e-mails, the use of Allen’s simple method suggests how to effectively processing our e-mails, in an ordered fashion, one by one, in a state “characterized by a sense of control, focus and well-being - in sharp contrast to the confusion, anxiety and procrastination that accompany the all-too-common situation of information overload”.^[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 as the allow readers to try them and, in case of success, to 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]

- One deals with the manageable task to process a finite number of e-mails, rather than an ever-expanding inbox.

- Avoid interruption from today’s e-mails.

- Better (more thoughtful and helpful) answers to 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 suitable option is batching e-mail topics and answer them at a specific time. One faculty, 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 answering 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] in the academy and in scientific research 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 analysis: absorption frequencies”.

- One topic, short, clear and proofread. An useful email is comprised of a short message directly focusing on the message content comprised of a single topic. No introductory text. Only important points of the message near the top, written in a clear and highly readable fashion. Only proofread text should be sent.

- Short, separated paragraphs. If the message requires two or three paragraphs, these should be short and separated by blank lines, avoiding 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.** Refrain from using e-mail-to-all messages, and especially reply-to-all messages.

5.4 Communicate and educate

It may be useful to communicate clearly and in advance one e-mail’s 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 5 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.

Education towards use e-mail more sparingly is also important. A scholar could teach people from her network that she meets regularly to avoid sending “in-between mails” instead telling them to bring those topic to the subsequent regular meeting. Similarly, to educate 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 might wish to do that without e-mails and instead answering questions publicly during lectures or stay after a lecture until all questions have been answered.

6. Outlook and Conclusions

We have explained elsewhere how the education of scientists *and* managers needs to be renewed by integrating science and management education within the culture as a unifying context.^[33] Accordingly, misuse of e-mail in the academy can be ended through expanded knowledge and renewed education. 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 and administrative staff to waste their valued time on e-mail minutia.

Universities reformed by managers literate in today’s management theory will focus again onto advanced teaching and research,^[25,26] prioritizing scholarly deep work, and thus abandoning the use of “urgent” e-mail-to-all messages by which, for example, faculties receive on almost a daily basis from administration the request to deliver spreadsheets and reports.

This study contributes by identifying selected recommendations to educate students on healthy and

productive utilization of electronic mail based on over two decades of scholarly research in the field. However, rather than suggesting one way to deal with the issue, and aware that knowledge workers tend to organize their work and time of work very differently, it proposes a spectrum of possible solutions concerning the way e-mails are written, read, answered and poor use of a most important information and communication technology prevented.

Acknowledgements

We thank one anonymous Reviewer for the profound comments to the first version of this study. This study is dedicated to David Allen for all he has done to advance time management from a set of recommendations to a practice accessible to all.

References

- [1] M. Nentwich, *Cyberscience*, Austrian Academy of Sciences Press, Vienna: **2003**
- [2] V. Bush, *As We May Think*, *Atl. Mon.* **1945**, 176 (1), 101-108.
- [3] S. Bartling, S. Friesike, (Ed.s), *Opening science*, Springer, Cham: **2014**.
- [4] P. Demma Carà, R. Ciriminna, M. Pagliaro, Has the time come for preprints in chemistry?, *ACS Omega* **2017**, 2, 7923-7928.
- [5] M. Weiss, D. Hanson-Baldauf, E-Mail in Academia: Expectations, Use, and Instructional Impact, *Educause Quarterly* **2008**, 31, 42-50.
- [6] A. Danielewicz-Betz, (Mis)use of e-mail in student-faculty interaction: Implications for university instruction in Germany, Saudi Arabia, and Japan, *Jalt Call J.* **2013**, 9, 23-57.
- [7] M. Pagliaro, Did you send it?, *ACS Cent. Sci.* **2019**, 5, 737-738.
- [8] F. A. Lagraña, *E-mail and Behavioral Changes: Uses and Misuses of Electronic Communications*, John Wiley & Sons, Hoboken: **2016**.
- [9] L. E. Weber, The Boy Who Invented E-mail, Honoring the Spirit of Innovation on The Anniversary of E-mail, *historyofemail.com*, **2018**. See at the URL: www.inventorofemail.com/the-boy-who-invented-email.asp (last accessed, May 31, 2019).
- [10] V. A. Shiva Ayyadurai, The Future of E-mail: Is Your E-mail Truly Free, Private and Secure?, *historyofemail.com*, **2018**. See at the URL: www.historyofemail.com/the-future-of-email.asp (last accessed, May 31, 2019).
- [11] N. Negroponte, *Being Digital*, Alfred A. Knopf, New York: **1995**.
- [12] J. B. Postel, Simple Mail Transfer Protocol, RFC 821, **1982**. See at the URL: <https://tools.ietf.org/html/rfc821>
- [13] R. Sooryamoorthy, W. Shrum, Does the Internet Promote Collaboration and Productivity? Evidence from the Scientific Community in South Africa, *J. Comput. Mediat. Commun.* **2007**, 12, 733-751.
- [14] F. Barjak, Research productivity in the internet era, *Scientometrics* **2006**, 68, 343-360.
- [15] W. W. Ding, S. G. Levin, P. E. Stephan, A. E. Winkler, The Impact of Information Technology on Scientists' Productivity, Quality and Collaboration Patterns, *NBER Working Paper No. 15285*, **2009**.

[16] M. Pagliaro, Chemistry Education Fostering Creativity in the Digital Era, *Isr. J. Chem.* DOI: 10.1002/ijch.201800179

[17] T. Jackson, R. Dawson, D. Wilson, The cost of e-mail interruption, *J. Syst. Inform. Technol.* **2001**, 5, 81-92.

[18] D. P. Brumby, C. P. Janssen, G. Mark, How Do Interruptions Affect Productivity? In *Rethinking Productivity in Software Engineering*, C. Sadowski, T. Zimmermann (Ed.s), Apress, Berkeley: **2019**.

[19] H. Taylor, G. Fieldman, Y. Altman, E-mail at work: A cause for concern? The implications of the new communication technologies for health, wellbeing and productivity at work, *J. Organ. Transf. Soc. Change* **2008**, 5, 159-173.

[20] K. Kushlev, E. W. Dunn, Checking e-mail less frequently reduces stress, *Comput. Hum. Behav.* **2015**, 43, 220-228.

[21] V. Huta, An overview of hedonic and eudaimonic well-being concepts, In *The Routledge Handbook of Media Use and Well-Being*, L. Reinecke and M. B. Oliver (Ed.s), Routledge, New York: **2017**; pp.14-33.

[22] W. J. Becker, L. Belkin, S. Tuskey, Killing me softly: Electronic communications monitoring and employee and spouse well-being, *Acad. Manage. Proc.* **2018**, 2018 (1): 12574.

[23] P. F. Drucker, *The Effective Executive*, HarperCollins, New York: **1967**; p.29

[24] J. Ziker, The Long, Lonely Job of Homo academicus, *The Blue Review*, 31 March 2014. See at the URL: <http://thebluereview.org/faculty-time-allocation/>

[25] C. Newport, *Deep Work: Rules for Focused Success in a Distracted World*, Grand Central, New York: **2016**.

[26] C. Newport, Is E-mail Making Professors Stupid?, *Chron. High. Educ.*, 12 February 2019. See at the URL: www.chronicle.com/interactives/is-email-making-professors-stupid

[27] D. Allen, *Getting Things Done*, Penguin Books, New York: **2001**.

[28] F. Heylighen, C. Vidal, Getting Things Done: The Science behind Stress-Free Productivity, *Long Range Plann.* **2008**, 41, 585-605.

[29] M. Forster, *Do It Tomorrow*, Hodder & Stoughton, London: **2008**.

[30] M. McGuinness, *Time Management for Creative People*, London: **2007**. See at the URL: <http://researchswing.org/others/creativetime.pdf>

[31] P. Watzlawick, J. Beavin Bavelas, D. D. Jackson, *Pragmatics of Human Communication*, W. W. Norton & Company, **2011**.

[32] For example, see at the URL: wetransfer.com

[33] M. Pagliaro, Science and Management: A New Alliance Within the Unifying Context of Culture, *Adv. Manag. Appl. Econ.* **2012**, 2, 1-18.