Writing scientific reports
(and other technical and scientific texts)

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why do we write reports?

projects often involve large teams

projects may take a long time (and our memory fails…)

projects involve different parties with contract responsibilities.

To present new findings

Bluetooth—A New Low-Power Radio Interface Providing Short-Range Connectivity

JAAP C. HAARTSEN, MEMBER, IEEE, AND SVEN MATTISSON, MEMBER, IEEE

In the past decades, progress in microelectronics and VLSI technology has fostered the widespread use of computing and communication applications in portable electronic devices. In this paper, we review the Bluetooth technology, a new universal radio interface enabling electronic devices to connect and communicate wirelessly via short-range connections. Motivations for the air interface design and radio requirement decisions are discussed. Frequency hopping, interference resistance, and the concepts of ad hoc connectivity and scatternets are explained in detail. Furthermore, Bluetooth characteristics enabling low-cost single-chip implementations and supporting low power consumption are discussed.

Keywords—*Ad hoc radio networks, low-power transceivers, short-range radio.*

I. Introduction

Imagine a cheap, power-efficient radio chip that is small enough to fit inside any electronic device or machine, provides local connectivity, and creates a (worldwide) microscale web. What applications might you use it in? Current portable devices use infrared links (IrDA) to communicate with each other. Although infrared transceivers are inexpensive, they have a limited range (1–2 m), require direct line-of-sight, are sensitive to direction, and can in principle only be used between two devices. In contrast, radios have much greater range, can propagate around objects and through various materials, and connect to many devices simultaneously. In addition, radio interfaces do not require user interaction: connections can be established without requiring any particular user knowledge (hidden computing, automatic synchronization of files, calendars, and so on).

At the end of 1997, several companies in the communications and PC industries identified the desire for local connectivity between electronic devices. A single standard for short-range radio connectivity will ensure interoperability between devices of different manufacturers. In February 1998, five major telecom and PC companies—Ericsson, Nokia, IBM, Toshiba, and Intel—formed a special interest group (SIG) to create a standard radio interface to fulfil this desire. The radio interface was named Bluetooth after a Danish Viking king Harald Blatand from the tenth century who united Denmark and Norway. This group was further expanded in December 1999 with 3Com, Lucent, Microsoft, and Motorola. In addition to these nine promoter companies, more than a thousand companies have joined as adopters of the Bluetooth technology. A year and half after its foundation, the Bluetooth SIG published the first version of the Bluetooth specification incorporating both radio protocols and control software [1], enabling manufacturers to start designing radio equipment and applications. The first Bluetooth products will emerge in mid-2000 and focus on mobile applications (mobile phones, notebook computers, and accessories; see Fig. 1). Conservative estimates foresee several hundred million Bluetooth-enabled devices in the next five years.

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II. Bluetooth Air Interface

The focus of user scenarios envisioned for first-generation products is typically on traveling business people: portable devices that contain Bluetooth radios would enable them to leave cables and connectors at home. Before the air interface for Bluetooth could be designed, however, certain requirements had to be satisfied.

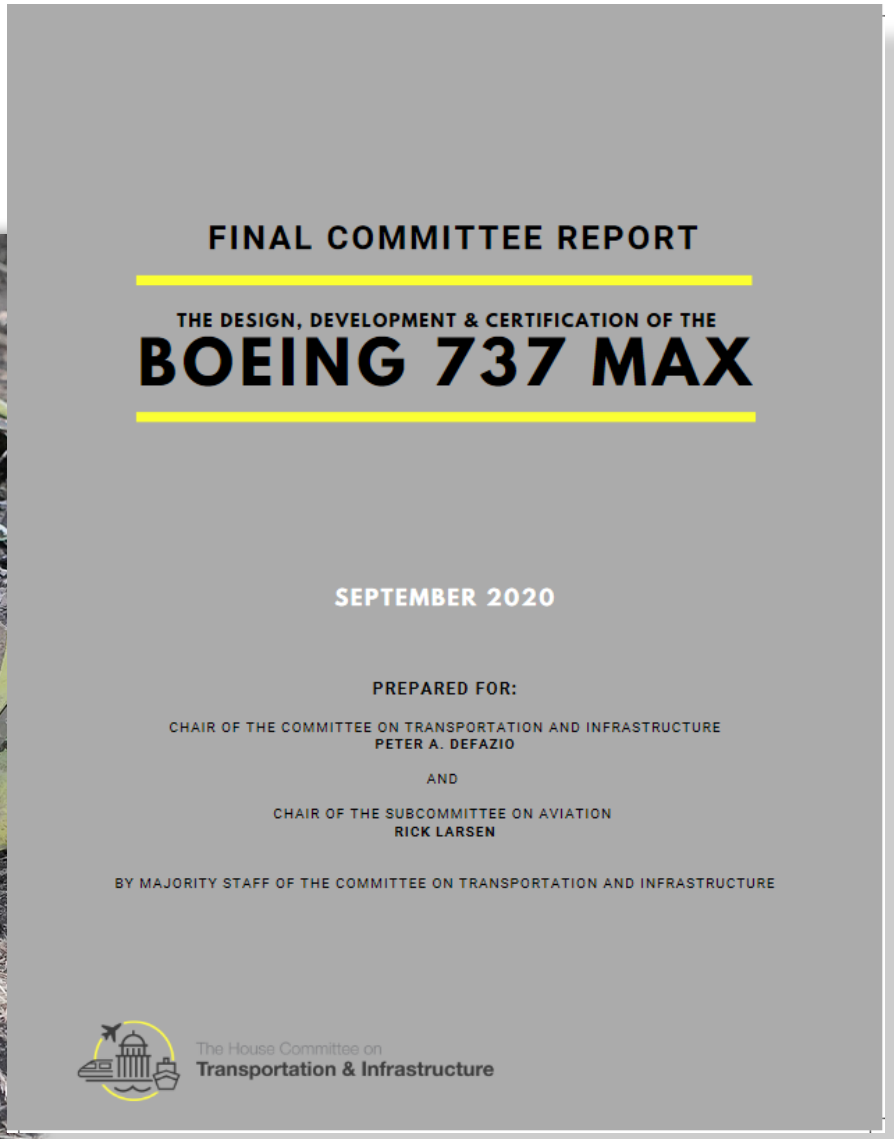
- The system must operate globally.
- The system must support peer connectivity—i.e., there is no wired infrastructure to provide call setup and networking functions: connections are made on an *ad hoc* basis.
- The connection must support voice and data—e.g., for multimedia applications.
- The radio transceiver must be small and operate at low power—i.e., the radio must fit into small, portable devices, such as mobile phones, headsets, and personal digital assistants (PDAs).

A. License-Free Band

To operate worldwide, the required frequency band must be available globally. Further, it must be license-free and open to any radio system. One frequency band that satisfies such requirements is at 2.45 GHz—the Industrial-Scientific-

Mattisson, S., & Haartsen, J. C. (2000). Bluetooth-a new low-power radio interface providing short-range connectivity. Proceedings of the IEEE, 88(10), 1651–1661.

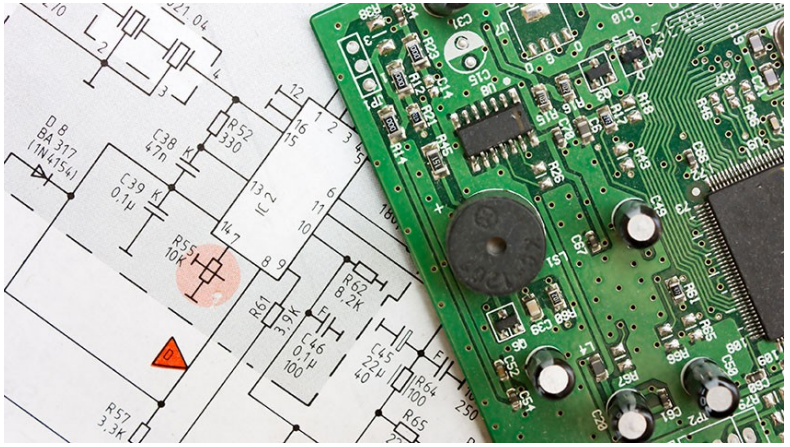
To prove or to find the reason for something



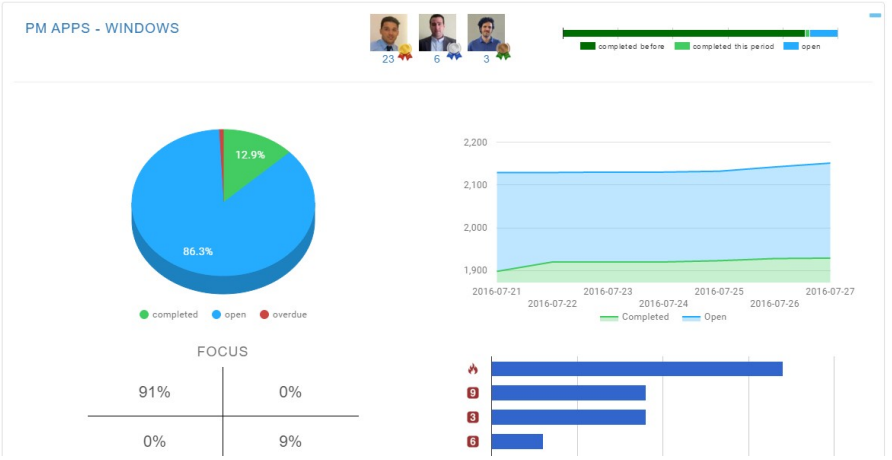
Peter A. DeFazio & Rick Larsen. (2020). The Design, Development & Certification of Theboeing 737 Max—Final Committee Report (p. 245). The House Committee on Transportation and Infrastructure. https://transportation.house.gov/imo/media/doc/2020.09.15%20FINAL%20737%20MAX%20Report%20for%20Public%20Release.pdf

what for?

Reference



Technical



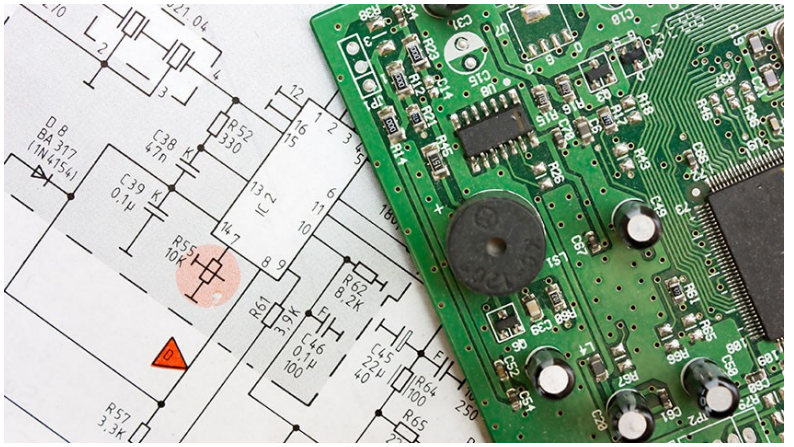
Reporting

Reference

- **Document created within the project or imported from other sources**
- **Mainly static: once created, does not change (much). Can be added or reviewed.**
- **Examples:**
  - Competition analysis: every project or company should have a place where all competing solutions and their main characteristics are recorded.
  - Technical solutions and suppliers: database of components, suplliers, … that may be useful for the project
  - Technical reports (a.k.a. Application Notes, Application Briefs, Technical Briefs, …)

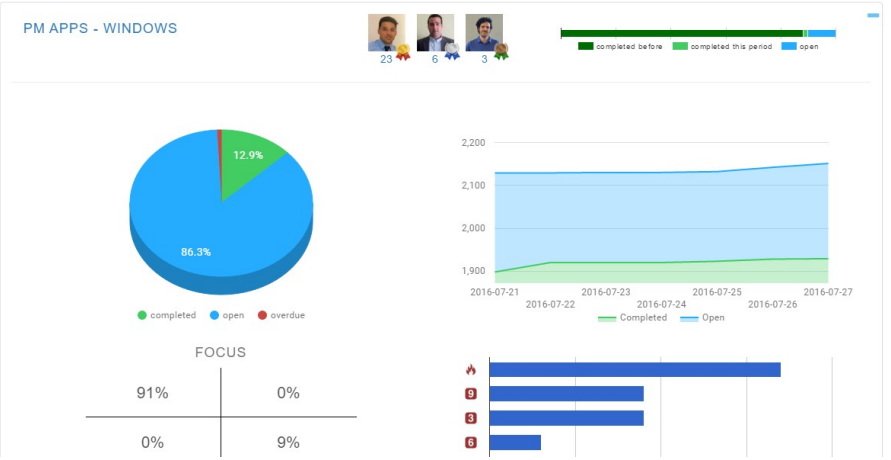
Technical

- **Ex.: schematics, source code, diagrams,...**
- **Dynamic: constantly changing as project evolves**
  - Should (must!) be supported by a VCS (Versioning Control System) such as git or other for code
  - many file storage services (eg. Onedrive, Dropbox, Google Drive, ...) have at least basic versioning control



Reporting

- **Example: Progress report,**
- **Fully static: once written, does not change**
  - Progress reports are a snapshot of the project's
  - They contain the status of technical documentation at a moment in time. They **are not technical documentation!**
    - meaning: to show the architecture of your system or how some device is built, you should not use a report; you should use the corresponding technical documentation



For a lab experiment at the University

https://durhamcollege.ca/programs/chemical-laboratory-technician

Key point:
(most of the times) you are not producing new results, but you are showing that you can implement a correct process to
- prove an hypothesis
- find a suitable cause
- …

what is a report?

Document to **report** how some work was performed
Communicate findings and results, as well as experience gained

what's in a report

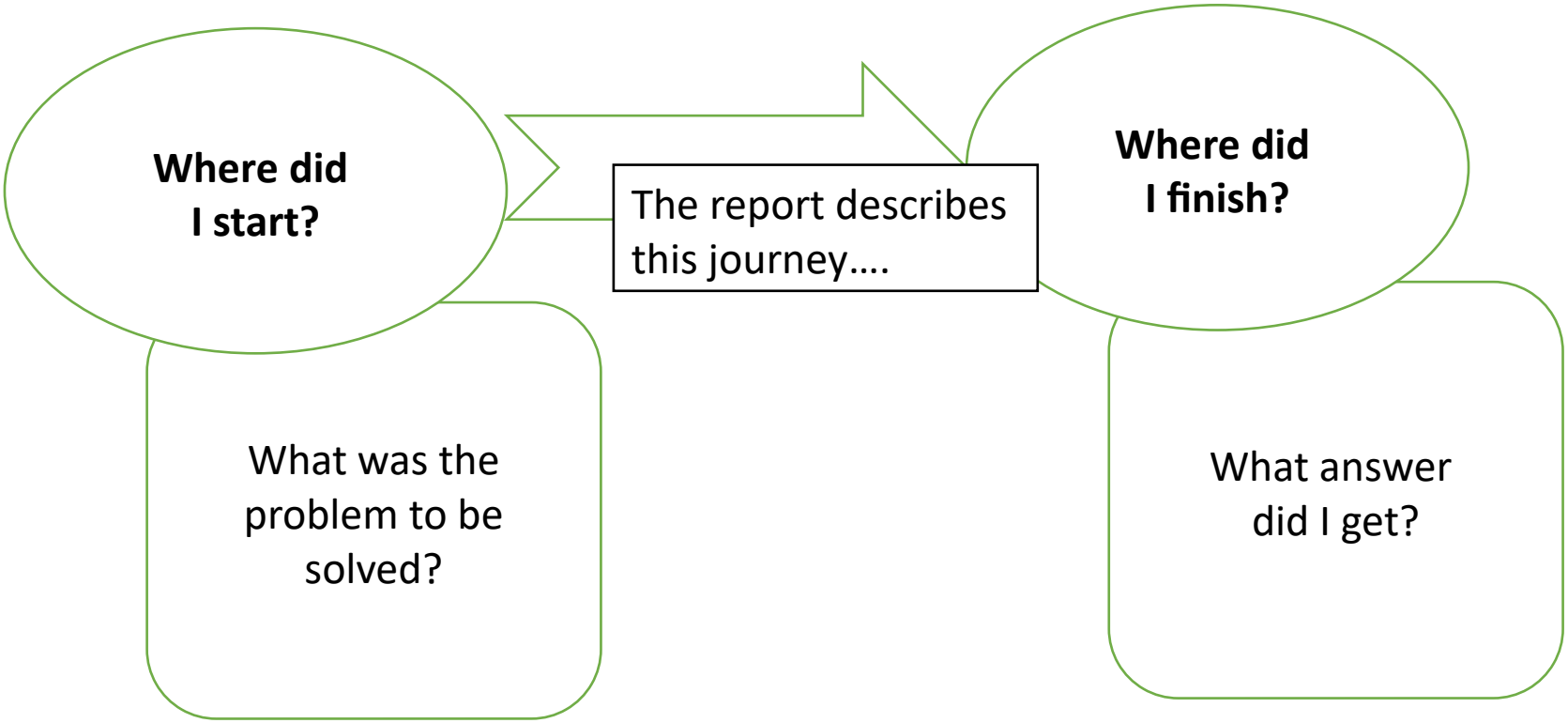
Results in a report must be **verifiable**. They must be based on **facts** and **evidences.**

Content is not true because some important person wrote the report

Content is true because:

- discovery followed a known method
- work is subject to scrutiny (can be reproduced by other people)

two basic questions



No point in writing a report if these two questions are not clear…

characteristics of a report

Concrete – a report deals with concrete data and evidence supported by reality. Only.

Concise – as short as possible (but not shorter than that…)

Complete – no important data or information is left out

Conclusive – no doubts after reading. All (or most) questions must be answered and closed. Open questions should be clearly stated.

identification

Who	Identifies the work author or authors
What	What is being reported. The title.
When	Date and location where work was performed
Where	
Why	Reason for the report to exist. Why did the author write the report; why should the reader read it.

First 4 questions go in the cover page
Question #5 is usually the *Abstract*

additional information

Other data to include in the information section:

- The organization (company, university) that hosted the work or to whom work was performed (may be different)
- Work context (project in a company, …)
- Supervisor
- Work sponsor

Organization of a scientific text

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Organization of a scientific text

Abstract

I ntroduction

M ethodology

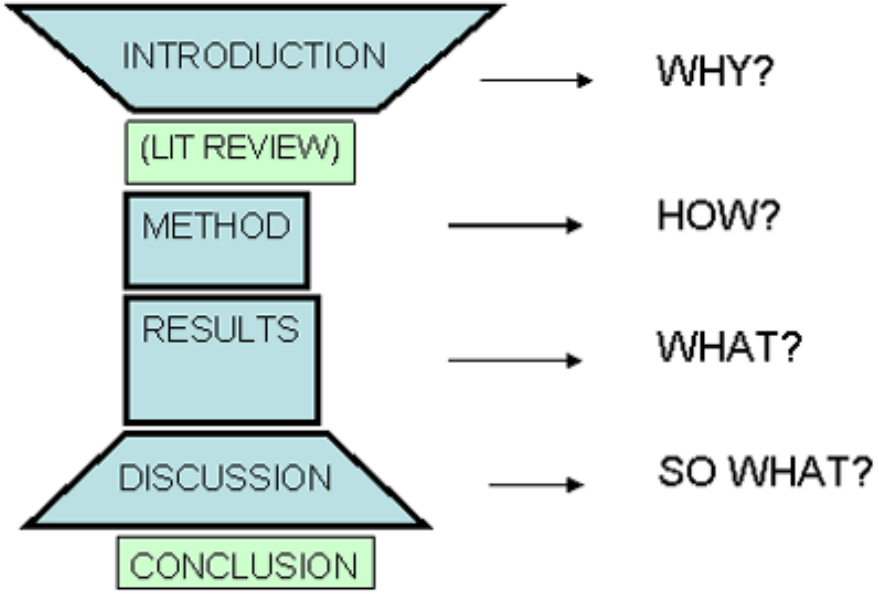
R esults

a nd

D iscussion

Conclusions

Bibliography



abstract

shortly state the problem, methodology, results and conclusions

often, decision to read/not read is done based on the abstract

introduction

present the work: what problem, context and justification, methodology, …

why was this work done?

introduction

Remember the 2 basic questions!

describe the problem (starting point)

problem context:

- state of the art (current knowledge on the subject)
- concurrent/alternative solutions

methodology

how did you do your work?

describe your actions without ambiguity (work must be reproducible)

results

what did you get?

raw results (no interpretation, no conclusions, no saying good or bad); just data

“dump” what you have seen

discussion / analysis

process *raw* data into usable data

apply formulas, calculate means and std devs, build graphs, …

make data more easily readable and understandable

discussion / analysis (2)

includes *critical analysis*: validate results. Do they match? Are they as expected? Do they seem to have any errors?

"Lawyer and detective" of data

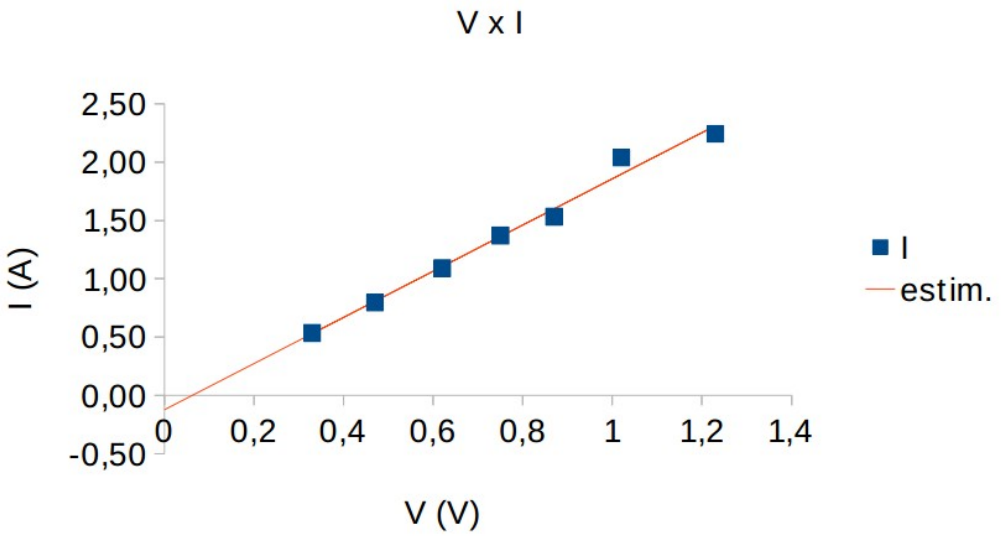
- lawyer: show that data can be trusted
- detective: do not rest before finding the reason why anything does not fit

Never try to embelish results!

(At the end, it will only mean that you were unable to see the errors!)

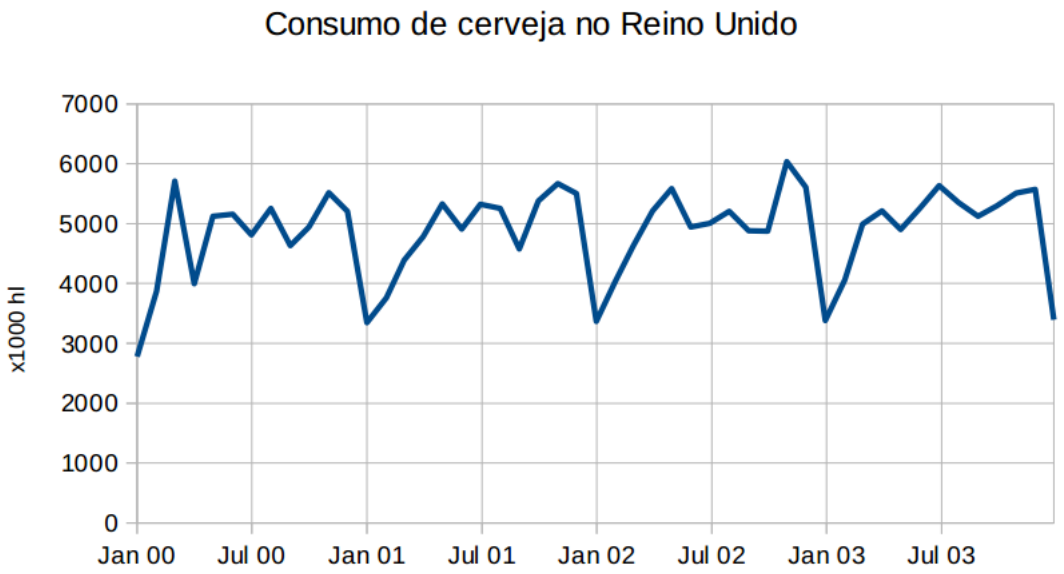
use of data: tables vs. graphs

V (V)	I (A)
0,33	0,54
0,47	0,80
0,62	1,09
0,75	1,37
0,87	1,53
1,02	2,04
1,23	2,24



The information is the same.
Our perception of what data means is different!

use of data: graphs



Patterns can be easily perceived in graphed data.

conclusions

Remember the 2 basic questions!

answer the question that justifies the report

there is no new data in the conclusions! Everything is based on what has been said before

conclusions state

- if a project reached results as expected
- if a research hypothesis was verified
- …

bibliography

elements that support the report

INSPIRING STUDENTS
TO PURSUE COMPUTING DEGREES

Their aspirations are our possibilities.

The dot-com demise, end of
resource planning rollout, com
overhauls, and offshoring have pr
decline in the recruitment of info
ogy professionals and, in turn, th
dents seeking degrees in computi
example, computer science, info
and so on [5, 11]. Despite an
turn, recent employment forecast
positions represent the fastest-growing job segment, with gr
exceed 30% by 2012 [8]. These competing forces imply th
qualified graduates produced by computing programs may
meet increasing industry demands. Addressing this situati
concerted effort toward attracting additional students to
disciplines.

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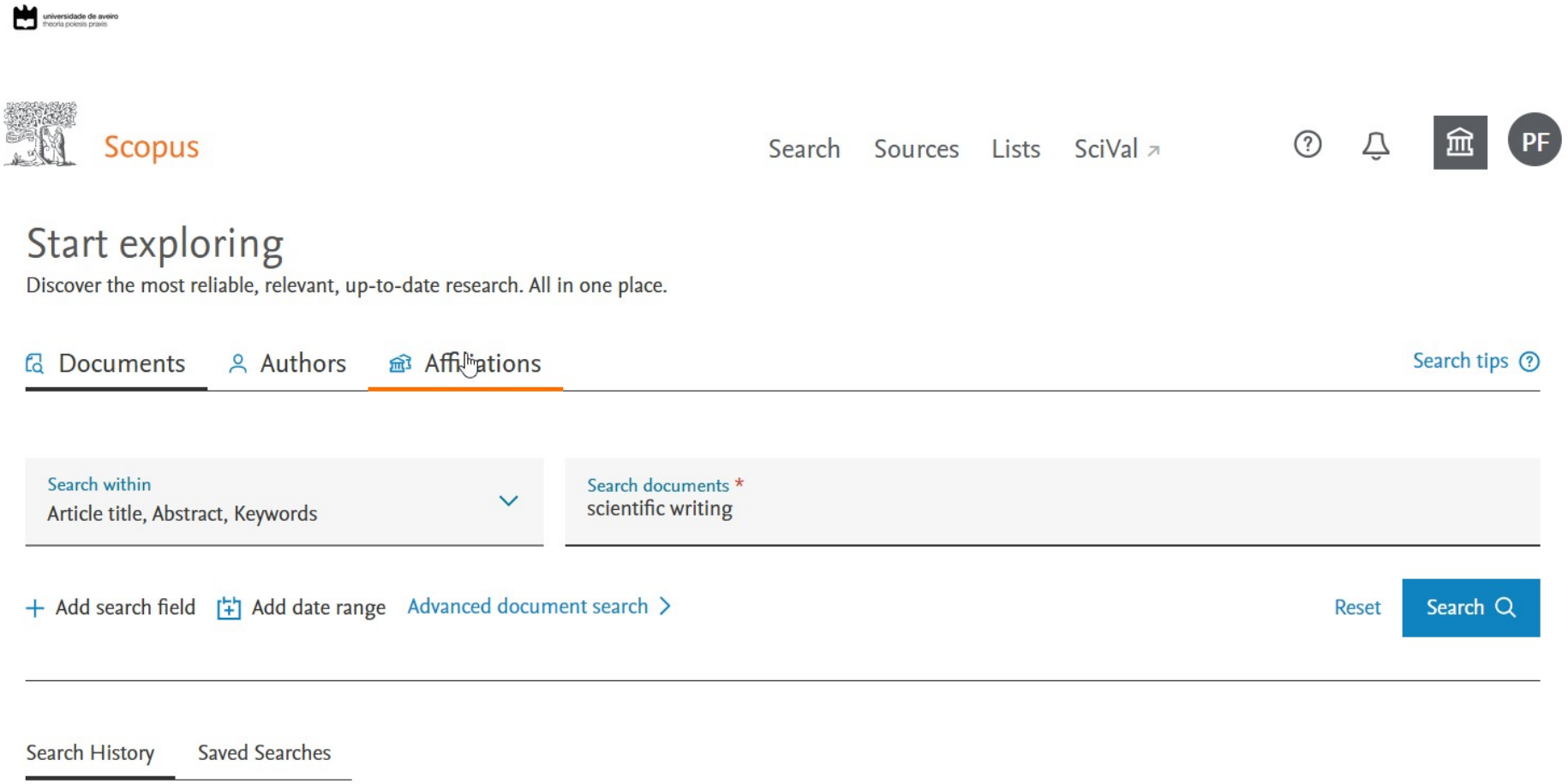

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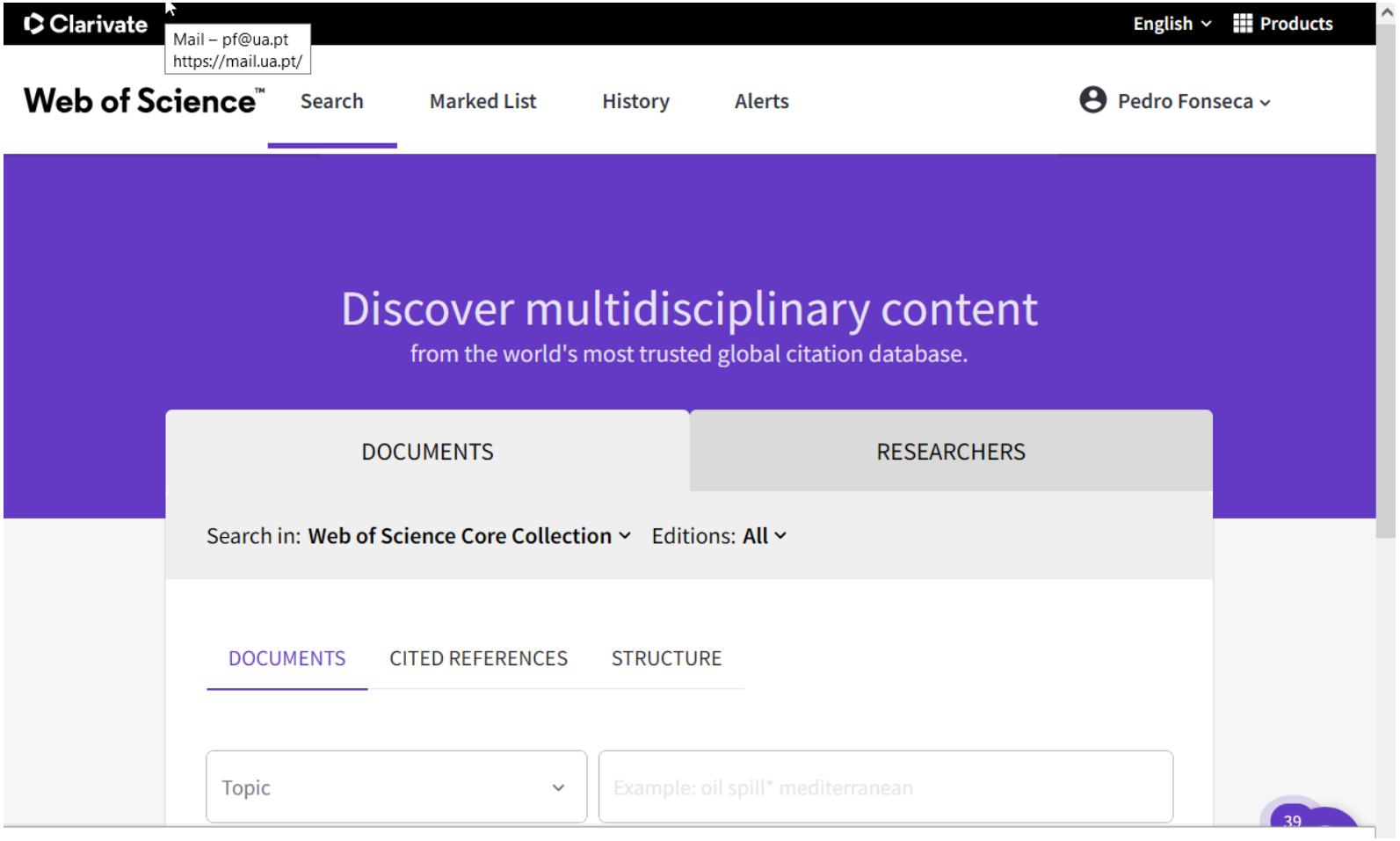

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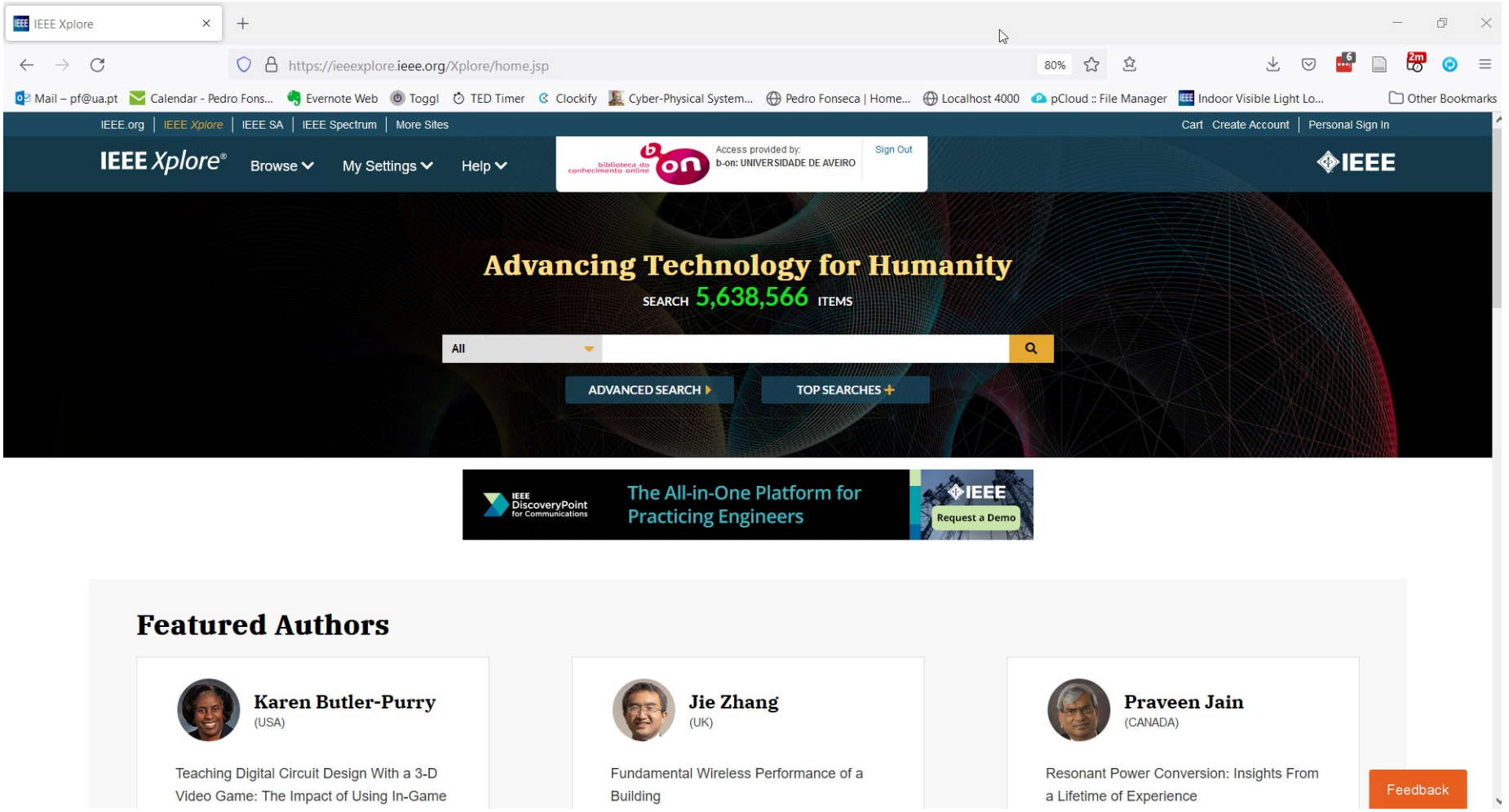

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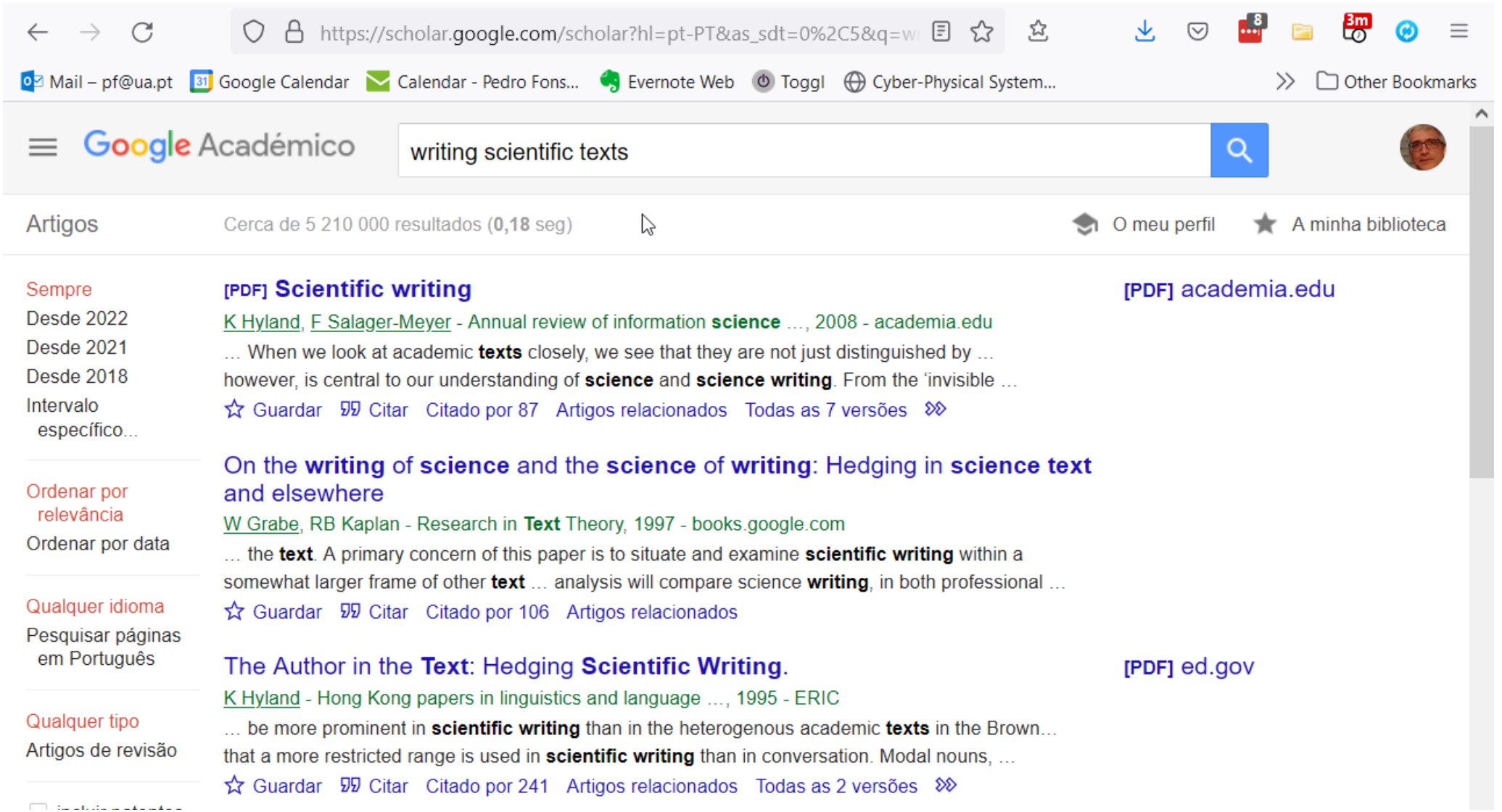


cholar.google.com/ **http://scholar.google.com/**

plagiarism and authenticity

Plagiarism is defined as the use of intellectual material produced by another person without acknowledging its source. Some examples [1]:

- Copying passages from works of others into one's homework, essay, term paper, or dissertation, without acknowledgement.
- Use of the views, opinions, or insights of another, without acknowledgement.
- Paraphrasing another person's characteristic or original phraseology, metaphor, or other rhetorical device, without acknowledgement.

[1] Examples are from the Center for Student Conduct, **Student Code of Conduct Violations**.

Source:
https://gsi.berkeley.edu/gsi-guide-contents/academic-misconduct-intro/plagiarism/

5 levels of plagiarism (IEEE)

1. Uncredited Verbatim Copying of a Full Paper, or Uncredited Verbatim Copying of a Major Portion (more than 50%) within a Single Paper
2. Uncredited Verbatim Copying of a Large Portion (greater than 20% and up to 50%) within a Paper
3. Uncredited Verbatim Copying of Individual Elements (Paragraph(s), Sentence(s), Illustration(s), etc.) Resulting in a Significant Portion (up to 20%) within a Paper
4. Uncredited Improper Paraphrasing of Pages or Paragraphs.
5. Credited Verbatim Copying of a Major Portion of a Paper without Clear Delineation

https://www.ieee.org/publications/rights/plagiarism/plagiarism.html

bad examples…

Gentlemen

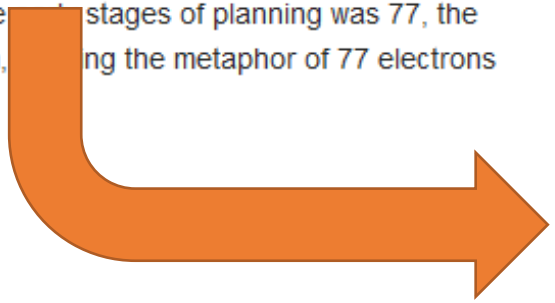
I note that on your web site the above student, xxxxxx xxxx has a document titled, "Information Systems and qualitative Research". This document was created on February 24, 2009. It is an exact copy of a paper I presented at a conference in Canberra, Australia in July of 2004. The title of my paper is "Qualitative Research in Information Systems: Consideration of Selected Theories"

I suggest you have a conversation with your student about plagiarism and the negative impact it has on the reputation of both the student and your institution.

always check brain is in gear before engaging word processor…

http://en.wikipedia.org/wiki/Iridium_Communications

a company, based in McLean, Virginia, United States which operates the Iridium satellite constellation, a system of 66 active satellites used for worldwide voice and data communication from hand-held satellite phones and other transceiver units. The Iridium network is unique in that it covers the whole Earth, including poles, oceans and airways. The company derives its name from the chemical element iridium. The number of satellites projected in the [illegible] stages of planning was 77, the atomic number of iridium, [illegible]ng the metaphor of 77 electrons



nave espacial geoestacionária.

A constelação de satélites Iridium é um sistema de 66 satélites de comunicação activa e peças de reposição em torno da Terra.

A rede Iridium é a única que abrange toda a Terra, incluindo os pólos, os oceanos e vias respiratórias, sendo utilizado desde 1998.

Os satélites utilizados são frequentemente visíveis no céu à noite como de curta duração flashes brilhantes, conhecidas como erupções Iridium.

Desde esta última descoberta, que os cientistas têm vindo na tentar inovar o mais possível estes corpos provenientes do

(quote of a student's work, submitted in 2010/11)

bibliography management

EndNote

Zotero

Obrigado!

Pedro Fonseca
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