Abacus:

When, where, and how has this technology been used in education?

ETEC565B: Intellectual Production #2

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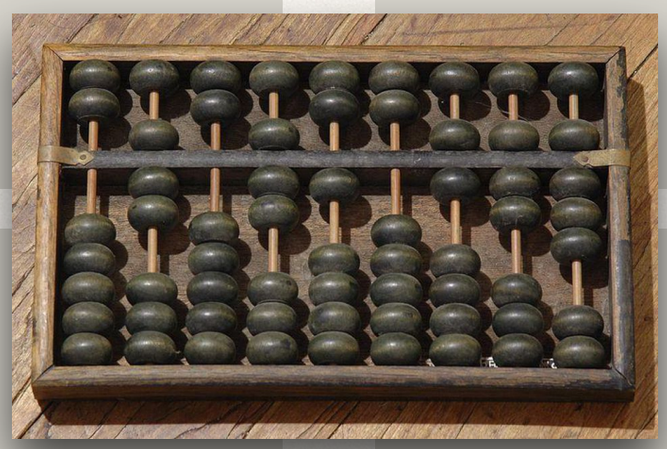
Situated in McLuhan's "tetrad"[1]…

ENHANCES

- mental abilities
  - ability to calculate large numbers at great speed
  - heightened cognitive skills and neurological activity
- social transactions before the numeral system was established
  - business activities
  - trade relationships

REVERSES

- more potent calculating abilities — the success of the abacus was far-reaching and inspired modern modifications that all followed after its particular logic, but what if other calculating methods or tools had taken root instead?



RETRIEVES

- cultural heritage
- human creativity

OBSOLESCES

- stones or other objects as numerical devices
- finger-counting
- inability to facilitate large calculations among uneducated merchants in early civilisation

[1] McLuhan, M. (1988). *Laws of the media: The new science*. University of Toronto Press.

When

has this technology been used in education?

The abacus is an ancient calculating tool that was used in the regions of early civilisation, as well as in China, Europe, and Russia. The tool dates back to centuries, even before the adoption of major numeral systems. In other words, it was a common counting device used across societies before it became known as an educational artifact.

- The origins of its invention and use is usually affiliated with Chinese civilisation in 200 BC[1]. From then onwards, archaeological evidence of its use can be found in various other early civilisations. As a common counting device, it made possible the calculation of large numbers for uneducated merchants, thus facilitating business relations, and some say, even trade relations between countries. While this may not draw direct links to educational use, the origins of its use nevertheless involved the transfer of a valuable skill to the common people at a time where comprehensive education systems were not yet in place.
- It is difficult to pinpoint the exact time the abacus made entry into formal educational systems. Ever since its widespread use in early civilisation, it was no longer a foreign instrument to developing societies, and eventually grew to become a widely incorporated tool for teaching arithmetic skills in schools across the globe. The abacus is still argued to be a "timeless computing tool that is still applicable in today's classrooms"[2].

[1] Ifrah, G. (2001). *The universal history of computing: From the abacus to the quantum computer.* New York, NY: John Wiley & Sons, Inc.

[2] Samoly, K. (2012). The history of the abacus. *Ohio Journal of School Mathematics, 65,* 58-66. Retrieved from http://hdl.handle.net/1811/78206

Where

has this technology been used in education?

Today, the abacus is most commonly used in pre-schools and elementary schools to develop early competencies for numeral systems and arithmetic concepts.

- Before abacus math was used for formal education, the method came to be simply as a solution for counting large numbers that would otherwise be extremely difficult with finger-counting before the numeral system came into place.
- One of the early adoptions of "abacus math" in formal education systems can be seen in the Italian Abacus schools dating back to the 13th century[1]. Today, abacus math is incorporated into educational syllabi across the globe. Abacus textbooks are often used as supplementary lessons or for practice outside the classroom.
- A lesser known use of the abacus is in public and state schools for the blind. An adapted abacus, called a Cranmer abacus, is used to teach students in early grades to perform basic mathematical functions via sensory contact. It teaches skills that cannot be replaced with talking calculators, and is thus an important learning tool for blind students[2].

[1] Michael of Rhodes Project Team, Dibner Institute, and WGBH Interactive. *"Abacus School"*. Glossary. Archived March 14, 2008, at the Wayback Machine Michael of Rhodes. Institute and Museum of the History of Science.

[2] Willings, C. (2012, June 9). Cranmer abacus instruction [Web log post]. Retrieved from https://www.teachingvisuallyimpaired.com/cranmer-abacus-instruction.htmla

How

has this technology been used in education?

Abacus math is not only performed with a physical abacus, but can be extended to mental abacus, where students are taught to mentally visualise an abacus to perform calculations.

- Research on the benefits of mental abacus for development has shown that the abacus system of mental calculation (AMC) trains students to outperform in arithmetic skills compared to those who have not had exposure to this method, in particular, to perform calculations at great speed[1]. This method of training is especially popular in China, Japan, South Korea, Singapore, Malaysia and Thailand. Such educational training has been argued to develop high-level cognitive skills in students, resulting in higher numerical memory capacity as well as more effectively connected neural pathways[2,3].

- Other culturally-situated adoption of the abacus for the purpose of teaching arithmetic skills include, but are not limited to: the Chinese Zhusuan, the Japanese Soroban and the Korean Chisanbop (adopts abacus principles without the physical tool).

[1] Shuzan.jp. (2019). *Soroban (Japanese Abacus) and the Right Brain.* Retrieved from http://www.shuzan.jp/english/brain/brain.html

[2] Hu, Y. et al. (2010). Enhanced white matter tracts integrity in children with abacus training. *Human Brain Mapping, 32*, 10–21. doi:10.1002/hbm.20996

[3] Wu, T-H. et al. (2008). Effects of long-term practice and task complexity on brain activities when performing abacus-based mental calculations: a PET study. *European Journal of Nuclear Medicine and Molecular Imaging, 36*(3), 436-445. doi:10.1007/s00259-008-0949-0

Fun facts

- The history of the abacus is highly contentious, leaving historians divided in their views even until today. There is still no consensus on who invented the tool, or when it was invented.

- The abacus is one of the few most primitive tools known in history that is still being used today for its efficiency in performing calculations and, as modern research reveals, improving neurological activity.

- Our modern computers use the binary abacus algorithm to manipulate numbers, such as the ASCII code.

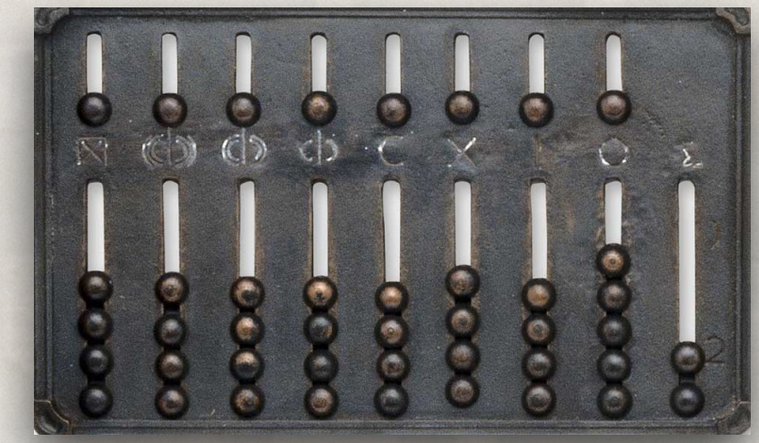
- A person who uses the abacus can be called an “abacist”; the plural being “abacai”.

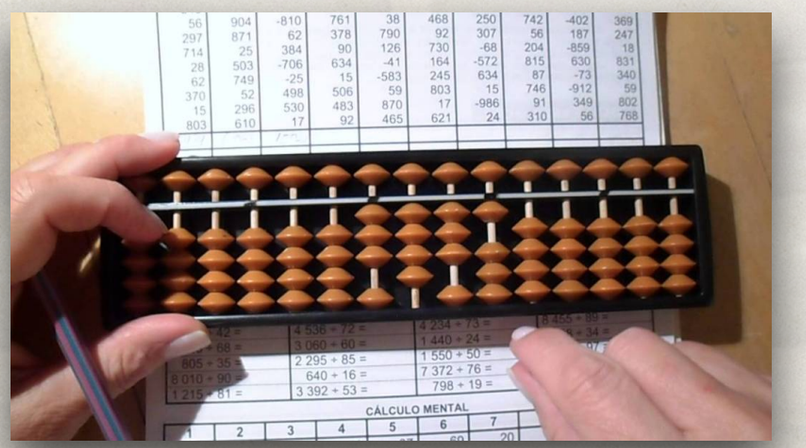
- Before the electronic era brought about calculators, the abacus evolved into the modern “slide-rule” — the last mechanical evolution of a portable calculating device, before it was made obsolete in 1972 by the invention of the Hewlett Packard HP-35 scientific calculator.

The abacus across cultures

CHINESE
"SUANPAN"

ROMAN
ABACUS





JAPANESE
"SOROBAN"

RUSSIAN
ABACUS