Mathematics \neq Science A study in citation rates over time

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- 2 Data & Methodology
- 3 Mathematical References & Citations Over Time
- 4 Mathematics Vs. Physics & Computer Science

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- 5 Mathematical Aging's Impact
- 6 Questions

 $\begin{array}{c} \mathsf{Mathematics} \neq \mathsf{Science} \\ \\ & {} \mathsf{Introduction} \end{array}$

STE & M???

Mathematics and Science often studied together

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STE & M???

Mathematics and Science often studied together
Both came from Natural Philosophy tradition

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STE & M???

- Mathematics and Science often studied together
 - Both came from Natural Philosophy tradition
 - Mathematics provides the foundation for Science

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Mathematics and Science often studied together

- Both came from Natural Philosophy tradition
- Mathematics provides the foundation for Science
- Gauss: "Mathematics is the queen of the sciences"

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But are they really that similar?

 $\begin{array}{l} \text{Mathematics} \neq \text{Science} \\ \\ & {} \Box_{\text{Introduction}} \end{array}$

A Foreign Queen

Mathematical Vs. Scientific Knowledge

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Mathematical Vs. Scientific Knowledge

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Proof - Experiment

Mathematical Vs. Scientific Knowledge

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- Proof Experiment
- Axiomatic Theoretic

Mathematical Vs. Scientific Knowledge

- Proof Experiment
- Axiomatic Theoretic
- Non-Empirical Empirical

Mathematical Vs. Scientific Knowledge

- Proof Experiment
- Axiomatic Theoretic
- Non-Empirical Empirical
- Chalkboard Vs. Laboratory

Mathematical Vs. Scientific Knowledge

- Proof Experiment
- Axiomatic Theoretic
- Non-Empirical Empirical
- Chalkboard Vs. Laboratory
- Funding Structures

 $\begin{array}{l} \mathsf{Mathematics} \neq \mathsf{Science} \\ \ \ \, \ \ \, \\ \mathsf{Data} \& \ \, \mathsf{Methodology} \end{array}$

Dataset

Clarivate Web of Science 1900-2017

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Big Ten Academic Alliance

 $\begin{array}{l} \mathsf{Mathematics} \neq \mathsf{Science} \\ \ \ \, \ \ \, \\ \mathsf{Data} \& \ \, \mathsf{Methodology} \end{array}$

Dataset

Clarivate Web of Science 1900-2017

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- Big Ten Academic Alliance
- Web of Science Categories

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Dataset

Clarivate Web of Science 1900-2017

- Big Ten Academic Alliance
- Web of Science Categories
 - Mathematics
 - Mathematics, Applied
 - Mathematics, Interdisciplinary Applications

Dataset

Clarivate Web of Science 1900-2017

- Big Ten Academic Alliance
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 - Mathematics
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- Physics*
- Computer Science*

Methodology

References & Citations

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Methodology

References & Citations

- References are the publications listed in a the original publication's bibliography (Past)
- Citations are the publications which cite the original publication (Future)

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Publication level analysis

Methodology

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- Publication level analysis
- Caveats

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 - Incomplete Data

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- References are the publications listed in a the original publication's bibliography (Past)
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- Publication level analysis
- Caveats
 - Incomplete Data
 - Reference date errors

Total Mathematical Publications





Table: Mathematical Publications in Web of Science

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Reference Age



Figure: Median Reference Age for Mathematical Publications

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Citation Age



Figure: Median Citation Age Per Mathematical Publications

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Citation Age



Figure: Median Oldest Citation Per Mathematical Publications

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Citation Age



Figure: % of Citations over 20 Years Old

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 $\label{eq:mathematics} \begin{array}{l} \mbox{Mathematics} \neq \mbox{Science} \\ \mbox{$$\sqsubseteq$} \mbox{Mathematics} \mbox{Vs. Physics & Computer Science} \end{array}$

Total Publications



Mathematics	Applied	Interdisciplinary Applications	Mathematics Total	Physics	Computer Science
74,2541	611,160	199,652	1,343,970	4,597,628	2,332,244
Table: Publications in Web of Science					

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Citation Age



Figure: % of Citations over 20 Years Old

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Figure: Median Oldest Citation Per Mathematical Publications

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Reference Age



Figure: Median Reference Age for Mathematical Publications

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 $\begin{array}{l} {\sf Mathematics} \neq {\sf Science} \\ {\sf \ } \\ {\sf \ } \\ {\sf Mathematical Aging's Impact} \end{array}$

Impact on Impact

Need to expand time frames for measuring mathematics

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Impact on Impact

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Impact on Impact

Need to expand time frames for measuring mathematics

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- 20 Years?
- 50 Years?

 $\begin{array}{l} {\sf Mathematics} \neq {\sf Science} \\ { \ } { \$

Impact on Impact

Need to expand time frames for measuring mathematics

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- 20 Years?
- 50 Years?
- 100 Years?

 $\begin{array}{l} \mbox{Mathematics} \neq \mbox{Science} \\ \mbox{$$\square$} \mbox{Mathematical Aging's Impact} \end{array}$

Impact on Impact

Need to expand time frames for measuring mathematics

- 20 Years?
- 50 Years?
- 100 Years?

And/Or we need to use different metrics

 $\begin{array}{l} {\sf Mathematics} \neq {\sf Science} \\ { \ } { \$

Impact on Collections & Acquisitions

Collections



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Impact on Collections & Acquisitions

Collections

Can't predict when something will become relevant

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No cut-off age

 $\begin{array}{l} \mbox{Mathematics} \neq \mbox{Science} \\ \mbox{${\hfill \mbox{-} Mathematical Aging's Impact}$} \end{array}$

Impact on Collections & Acquisitions

- Collections
 - Can't predict when something will become relevant

- No cut-off age
- Can anything be weeded?

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Impact on Collections & Acquisitions

Collections

Can't predict when something will become relevant

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- No cut-off age
- Can anything be weeded?

Acquisitions

Impact on Collections & Acquisitions

- Collections
 - Can't predict when something will become relevant

- No cut-off age
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- Acquisitions
 - Age is irrelevant (for research publications)

Impact on Collections & Acquisitions

- Collections
 - Can't predict when something will become relevant
 - No cut-off age
 - Can anything be weeded?
- Acquisitions
 - Age is irrelevant (for research publications)
 - Stay on top of old material which has become relevant

 $\begin{array}{l} \mathsf{Mathematics} \neq \mathsf{Science} \\ {} {\textstyle \bigsqcup_{\mathsf{Questions}}} \end{array}$

Questions

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