How to evaluate the quality of research publications: problems and suggestions

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Neurite arborization and mosaic spacing in the mouse retina require DSCAM

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What is the quality of research publications? How we measure it?

Conventional indicators to evaluate publications:

- Volume
- Quantity
- Quality
• # of publications
  Article
  Review
  Proceedings
  Book
  Book Chapter

Basically counts English publications (Not all Japanese publications)

“Volume” of publications depends on the database.
“Citations” is an essential indicator.
*NOTE: “Impact Factor” is not equal to “Citations”

- Differences by literature types
  Different trends in Article and Review
  Review is cited a lot.

- Differences by research field
  Differences in citations by field
  Medical sciences are heavily cited

- Normalized Citation Index: FWCI （Field Weighted Citation Impact）
  Corrected for literature type and field. The global average is set to 1.

- Top percentile publication ratio: top 1%, 10%
"Quality" is based on the number of citations.

Differences by research field

Differences in citations by field

Medical sciences are heavily cited
Normalized “Citations” by scientific field

FIELD-WEIGHTED CITATION IMPACT (FWCI)

# of citations received by a document
expected # of citations for similar documents

Similar documents are ones in the same discipline, of the same type (e.g., article, letter, review) and of the same age. An FWCI of 1 means that the output performs just as expected against the global average. More than 1 means that the output is more cited than expected according to the global average; for example, 1.48 means 48% more cited than expected.

https://libraryconnect.elsevier.com/metrics
The Problem of University’s FWCI

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<th>University B</th>
<th>University C</th>
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The FWCI takes “Averages” (\(\sum \text{FWCI} / \# \text{of publications}\)), so there is a danger that even one outstanding paper will be heavily biased.
Another aspect of a university's research capabilities

How thick/deep is the research capacity of the university?

ATSUMI Substantiality

Quantity of papers with a certain level of Quality
https://doi.org/10.2478/jdis-2021-0029
ATSUMI index: institutional h5-index （5 means the period of 5 years）

Publication Set in Research Field X

One lucky strike

University A
Total # of Publications: 9
Total # of Citations: 66
Average Citations per Publications: 7.3
# of Top Percentile Publications: 1

University B
Total # of Publications: 7
Total # of Citations: 47
Average Citations per Publications: 6.7
# of Top Percentile Publications: 0

*# in circles = citations
ATSUMI metrics (for publications): institutional h5-index (institutional h count over the past 5 years)

### University A

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</table>
**University A**
- Total # of Publications: 9
- Total # of Citations: 66
- Average Citations per Publications: 7.3
- # of Top Percentile Publications: 1
- ATSUMI institutional h5-index: 3

**University B**
- Total # of Publications: 7
- Total # of Citations: 47
- Average Citations per Publications: 6.7
- # of Top Percentile Publications: 0
- ATSUMI institutional h5-index: 6

*# in circles = citations*
Example:

**University A**

- Total # of publication: 22374
- FWCI: 1.15
- Top 1% ratio: 1.41%
- Top 10% ratio: 12.2%
- Institutional h5-index: 108

**University B**

- Total # of publication: 5817
- FWCI: 1.30
- Top 1% ratio: 1.87%
- Top 10% ratio: 12.9%
- Institutional h5-index: 87
# of citations

publications
Five Key Indicators to Measure Research Capability

The combination of these five indicators will be used to understand your university research capability.

**Volume (Quantity)**
- # of publications

**Quality**
- FWCI
  - **Top 10% publication ratio**
- ATSUMI
  - # of Top10% publications
  - Institutional h5 index

**Internatinality**
- CNI (fractional)
  - **International collaboration ratio**

**# of researchers**
- **active authors**

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Koizumi, Shirabe and Toriya (2021)
STI Horizon Vol.7. No.1
https://doi.org/10.15108/stih.00248
2021 March 22
ATSUMI (Substantiality) correlates with university’s “reputation”

The correlations of substantiality indicators (i.e. h5-index and number of top 1% most cited publications (Kutlača, 2015)) to research reputation scores in the top 50 universities are clearly higher than those of the number and FWCI of publications (Elsevier, Scopus/Scival)

ATSUMI (Substantiality) has “predictive power” of university’s “reputation”

Spearman's rank correlation coefficient between “reputation” and Quality and ATSUMI research capability indexes (Elsevier, Scopus/Scival)

Still we have Problems:

- Quality and ATSUMI indexes need “Citations”
  You need to wait several years after publication of a paper to determine the number of citations.
  Also, the number of years it takes to be cited varies depending on the research field.

- We need an index that does not rely on "citations," that can evaluate "quality" instantly, regardless of the field, rather than taking years to evaluate.

- We need early indicators that can predict the number of citations, and reputation in the future.
Non-Citation based “Quality” measurements

• Nature Index by SpringerNature

A database of author affiliation data drawn from primary research articles in a select group of 82 high quality natural science journals.

# of publications in 82 high quality natural science journals.

It is a close to real-time indicator of high quality research output and collaboration in the natural sciences at the institutional, national, regional and international level.
Preprints might be the game changer, but Questions: How can Preprints ensure the quality of future publications and the impact of research?

• Can we predict the quality of future publications by analyzing their Preprints?
• Can we predict impact by analyzing their Preprints?
Working Hypothesis

Preprints

Downloads
Views

Another metrics?

Publications

Citations

Quality

ATSUMI

Reputations

Impacts

Quantity (Volume)

unknown
Correlation between Downloads and Citations

Figure Legend:
Total downloads vs total citations. We add 1 to citations to allow it to be plotted on a log scale.
• As previous reports have shown, the number of downloads will correlate with the number of citations in the future.

• But in that case, the number of downloads for the preprint can only be substituted for the number of citations in the publication!

• Normalization will be needed for each research field.

• It would be valuable if other preprint analysis metrics could estimate the "quality" of a paper, independent of the number of citations, and directly predict its future reputation.
The publication of preprints should be considered as a process of research activities and not a research result.
How much can we trust “peer-review”? That is another question.
I appreciate your comments and suggestions.

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