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## Citation Rates for Ohio State Graduate Theses & Dissertations: Trends, Surprises, and Inaccuracies

Daniel S. Dotson

Ohio State University - Main Campus, [dotson.77@osu.edu](mailto:dotson.77@osu.edu)

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# Citation Rates for Ohio State Graduate Theses & Dissertations: Trends, Surprises, and Inaccuracies

## **Abstract:**

The Ohio State University's holdings of graduate theses and dissertations were examined to determine if highly-downloaded titles tended to be highly-cited. The study found that citation rates were highly variable and did not necessarily correspond to download rates. This included very highly downloaded titles with low citation rates, and lesser-downloaded titles with high citation rates. The study found that Google Scholar, which was used to identify citation rates, too often counts theses and dissertations as a version of a different work with the same title, even if it is another format and sometimes with additional authors. This article will share these findings.

## **Introduction:**

This article examines the citation rate for the most-downloaded electronic graduate theses and dissertations (ETDs) from The Ohio State University's holdings in the OhioLINK Electronic Theses and Dissertations center. The ETDs were examined in Google Scholar to determine citation counts and the data were analyzed to determine if highly-downloaded ETDs tended to also be highly-cited. It was also a goal to determine if certain disciplines tended to have higher citation rates.

## **Literature Review**

Download rates have received a fair amount of coverage in the literature, including the previous study of this data addressing the download rates of ETDs (Dotson 2019). However, citation rate information is a good bit scarcer in the literature. Ferreras-Fernández et al. (2016) also examined download rates of open access ETDs, but went further and used Google Scholar to examine citation rates of their titles. This study found that for broad disciplines the percentage of ETDs that have been cited were:

- Experimental sciences: 15.69%
- Humanities: 9.80%
- Social sciences: 9.80%
- Life sciences: 5.88%
- Technological sciences: 1.96%

Stone and Lowe (2014) focused efforts on undergraduate theses from multiple institutions. They too used Google Scholar to examine 20,024 theses from 49 repositories. They found that some repositories' theses were not in Google Scholar and that only 811 (4%) of the 20,024 theses had been cited, with total of 1,390 citations. The citation counts ranged from 1-47, with the vast majority (580) having only a single citation. The authors also determined the source of the citations. They found most of these came from journals articles (24.5%, including non-peer reviewed journals) and theses of all types (33.3%, with other undergraduate theses being the highest) being the top citing formats. They also found that higher-level Carnegie Classification institutions tended to have better citation rates.

Kousha and Thelwall (2019) focused on titles from the ProQuest Dissertations and Theses database and how Google Scholar and Mendeley impacted their use and citation. In addition to these tools, they made use of the Publish or Perish tool in order to interact with Google Scholar. They found that for dissertations from the social sciences and arts/humanities disciplines, the proportions with at least one citation were higher than science, technology, and biomedical areas. They also found that about 20% of the titles identified had at least one citation. This study took a much more in-depth look at titles and how Mendeley readership came into play.

These studies combined seem to indicate overall that a lot of ETDs do not get cited. However, the interesting details about these studies also show the different nuances of citations, ranging from citation source to interaction with advanced researcher tools. This study will focus more on the citation rates.

## **Methodology**

Data about the ETDs was provided by OhioLINK staff and included 51,375 titles. Data includes typical ETD metadata (title, author, department, graduation year, etc.) and information on downloads. Corrections were made to variations in department names. A mass influx of older digitized doctoral theses was listed under Graduate School rather than their specific department.

The ETDs were sorted according to downloads (highest to lowest, including those with no downloads). Total downloads for all titles was calculated and the 2,899 titles (out of 51,375 total) that constituted the 50% of the downloads were examined more closely in Google Scholar to determine how much the highest-downloaded titles were being cited. Google Scholar was chosen as it is the only major database that tracks citations for theses and dissertations and it also has a much broader base for its citation counts as well. A title search was conducted, and the number of citations was recorded. Note this information may have changed since the time of title examination.

## Results

Examining the items, the citation counts were divided into ranges of downloads, as outlined in Tables 1 and 2. Nearly 95% of the items had 25 or fewer citations and over 83% had 10 or fewer. Only 0.9% (26 items) had over 100 citations. Many (24.08% or 698 ETDs) were not cited at all, despite high download rates. Two items could not be found.

<b>Citation Count Range</b>	<b>Total items</b>	<b>%</b>
NA	2	0.07%
0	698	24.08%
1-25	2043	70.47%
26-50	94	3.24%
51-100	36	1.24%
101-1076	26	0.90%

Table 1: Google Scholar Citation Counts – groups of 25

<b>Citation Count Range</b>	<b>Count</b>	<b>%</b>
NA	2	0.07%
0	698	24.08%
1-10	1717	59.23%
11-20	260	8.97%
21-30	100	3.45%
31-40	33	1.14%
41-50	27	0.93%
51-60	11	0.38%
61-70	10	0.34%
71-80	5	0.17%

81-90	6	0.21%
91-100	4	0.14%
101-1076	26	0.90%

Table 2: Google Scholar Citation Counts – groups of 10

By degree, Doctoral degrees in this list were cited at nearly twice the rate that the Masters items were cited. See Table 3 for a breakdown. So while overall the ETDs studied tended towards lower (or no) citation numbers, Doctorial titles tended to have better citation rates that the Masters titles.

<b>Degree</b>	<b>Total Titles</b>	<b>Cite Totals</b>	<b>Average Cites/ETD</b>
Doctoral	2113	20194	9.56
Masters	786	3912	4.98

Table 3: Cites by Degree

Departments varied widely in terms of the citation rate of their ETDs (Tables 4 and 5). A total of 19 (20.43%) of the departments averaged over 10 citations per ETD. Linguistics was the department with the highest average citation rate (44.94), followed by Computer Science and Engineering (33.64), and Management and Human Resources (19.71). See Table 5 for the ten departments with the highest citation rates. The departments with high citation rates came from a broad range of, although visual and performing arts areas were not present in this top ten list. Six departments (6.45%) had no ETDs from this group of titles with citations and 20.43% (19) of the departments had 10 or more citations on average. Most departments had titles with citations, but only 20.43% of the departments averaged ten or more citations per ETD. See Table 6 for a breakdown by average Google Scholar cites range.

<b>Department/Program</b>	<b># ETDs for Department</b>	<b>Total Google Scholar Cites</b>	<b>Average Google Scholar Cites for Department</b>
Accounting and Management Information Systems	5	18	3.60

African-American and African Studies	8	14	1.75
Agricultural and Extension Education	12	101	8.42
Agricultural Communication, Education, and Leadership	11	153	13.91
Agricultural, Environmental and Developmental Economics	40	305	7.63
Animal Sciences	9	15	1.67
Anthropology	16	163	10.19
Architecture	3	4	1.33
Art	10	9	0.90
Arts Administration, Education and Policy	55	200	3.64
Astronomy	2	28	14.00
Biomedical Engineering	7	30	4.29
Biophysics	7	13	1.86
Biostatistics	1	0	0.00
Business Administration	49	348	7.10
Chemical and Biomolecular Engineering	67	431	6.43
Chemical Physics	2	0	0.00
Chemistry and Biochemistry	55	151	2.75
City and Regional Planning	13	35	2.69
Civil Environmental, and Geodetic Engineering	44	343	7.80
Classics	17	40	2.35
Communication	50	114	2.28
Comparative and Veterinary Medicine	2	0	0.00
Comparative Studies	7	29	4.14
Computer and Information Science	8	69	8.63
Computer Science and Engineering	25	841	33.64
Dance	4	8	2.00
Dentistry*	35	564	16.59

Design	14	20	1.43
Earth Sciences	17	190	11.18
East Asian Languages and Literatures	71	289	4.07
Economics	24	62	2.58
Educational Studies	165	2205	13.36
Electrical and Computer Engineering	167	2222	13.31
English	59	128	2.17
Entomology	12	37	3.08
Environment and Natural Resources	46	202	4.39
Evolution, Ecology, and Organismal Biology	14	132	9.43
Food Science and Technology	81	379	4.68
Food, Agricultural and Biological Engineering	34	187	5.50
French and Italian	23	27	1.17
Geography	21	85	4.05
Germanic Languages and Literatures	9	32	3.56
Graduate School	16	171	10.69
Health and Rehabilitation Sciences	29	31	1.07
Health Services Management and Policy	1	0	0.00
History	112	477	4.26
History of Art	23	45	1.96
Horticulture and Crop Science	30	119	3.97
Human and Community Resource Development	2	30	15.00
Human Sciences*	183	1309	7.19
Industrial and Systems Engineering	57	432	7.58
Integrated Biomedical Sciences	7	6	0.86
Interdisciplinary Programs	5	11	2.20
Landscape Architecture	5	7	1.40

Linguistics	35	1573	44.94
Management and Human Resources	7	138	19.71
Materials Science and Engineering	103	1593	15.47
Mathematics	17	72	4.24
Mechanical and Aerospace Engineering	219	2430	11.10
Microbiology	3	18	6.00
Molecular Genetics	1	1	1.00
Molecular, Cellular, and Developmental Biology	12	17	1.42
Music	177	987	5.58
Near Eastern Languages and Cultures	14	16	1.14
Neuroscience	4	0	0.00
Nursing	12	132	11.00
Nutrition	5	8	1.60
Occupational Therapy	1	2	2.00
Optometry	12	32	2.67
Oral Biology	2	13	6.50
Pharmacy	28	41	1.46
Philosophy	9	129	14.33
Physics	19	95	5.00
Physiology and Cell Biology	1	0	0.00
Plant Pathology	20	38	1.90
Political Science	44	408	9.27
Psychology	71	1154	16.25
Public Affairs	6	18	3.00
Public Health	13	88	6.77
Slavic and East European Languages and Cultures	14	36	2.57
Social Work	21	164	7.81
Sociology	31	442	14.26
Spanish and Portuguese	32	111	3.47



Speech and Hearing Science	13	19	1.46
Statistics	6	35	5.83
Teaching and Learning	86	1104	12.84
Theatre	45	283	6.29
Veterinary Biosciences	2	1	0.50
Veterinary Clinical Sciences	6	16	2.67
Veterinary Preventive Medicine	12	29	2.42
Women's, Gender and Sexuality Studies	5	2	0.40
<b>Grand Total</b>	<b>2899</b>	<b>24106</b>	<b>8.32</b>

Table 4: Citations by Department of Top 50% of Downloads

*\*One title in this department could not be found in Google Scholar, so average based on one title less.*

Department	# ETDs for Department	Total Google Scholar Cites	Average Google Scholar Cites for Department
Linguistics	35	1573	44.94
Computer Science and Engineering	25	841	33.64
Management and Human Resources	7	138	19.71
Dentistry*	35	564	16.59
Psychology	71	1154	16.25
Materials Science and Engineering	103	1593	15.47
Human and Community Resource Development	2	30	15.00
Philosophy	9	129	14.33
Sociology	31	442	14.26
Astronomy	2	28	14.00

Table 5: Top 10 Departments – Average Google Scholar Cites

*\*One title in this department could not be found in Google Scholar, so average based on one title less.*

Average Citation Range	Count of Departments	%
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0	6	6.45%
0.40-10	68	73.12%
10-44.94	19	20.43%

Table 6: Average Citation Ranges

In terms of year ranges, most of the titles in the list were items that were from the year 2000 or later, which roughly corresponds to items originally submitted to the OhioLINK ETD Center per Graduate School requirements (required for Doctorial 2002-present, Masters 2008-present) as opposed to items that were added as digitized items or voluntarily by students. However, items from the 1990s had the highest average citation rate. Of course, more time to get cited is a factor that would at least partially explain the differences between the year ranges. See Table 7 for details.

Year Range	Count	Average
2010-2017	908	4.20
2000-2009	1752	9.64
1990-1999	108	19.44
1980-1989	57	11.68
1934-1979	72	8.75

Table 7: Average Citation by Year Range

This data seems to differ from the studies mentioned in the Literature Review. Citation rates tended to be higher than the other studies indicated. However, Ohio State's Carnegie Classification would point towards Stone and Lowe's (2014) findings that such institutions tend to get more citations. The subject areas having a mix of citation rates findings, being a bit mixed in the other two studies mentioned in the Literature Review is similarly mixed in the findings in this study that also showed varying citation disciplines reflected the top-cited departments.

### **Inaccuracies with Google Scholar's Citation Rates: Versions That Are Not Versions**

It was seen in some cases, but particularly when examining highly-cited titles, that Google Scholar's citation count can be highly flawed. An examination of the "versions" for some highly cited items revealed that Google Scholar sometimes combines ETDs

with other formats (journal articles, books, conference papers, etc.) into one citation count when the titles and at least one author match.

This last statement – at least one author match– is particularly concerning about Google Scholar’s citation counts. In many cases, Google Scholar combined items with different author names and quantity if at least one author and title matched. In other words, Google Scholar would consider a single-authored ETD to be a version of an article, book, conference paper, or some other item even if the other item has additional authors (and potentially different page lengths and content). What does this mean to the citation rates?

- The citations could be to any items in its list of “versions.” In other words, the count does not necessarily apply to any one work.
- Google Scholar does not parse out citations for the different versions. Authors may receive citation credit for a work they did not author when Google Scholar misidentifies an ETD as a version of an article. In other words, some authors of a journal article may get a citation count in Google Scholar that is inflated if people cited an ETD (listed as a version) of their journal article, conference paper, etc. that is listed as solely authored (note that a small number of ETDs had more than one author).

Examining the 25 most cited titles, many had versions that were other formats (see Table 8). A number were in online repositories (for one of their versions) that were not publisher-based nor the OhioLINK ETD Center. In some cases, the versions were just different iterations of the same item on the same site (i.e., multiple links to the OhioLINK ETD Center or to a publisher site).

It was noted if an ETD was found on free non-OhioLINK repositories. Sometimes these were versions of the ETD and sometimes versions of the other format(s). These include sites like eLibrary.ru, academia.edu, and researchgate.net. Additionally, some versions were simply the items indexed in free online search tools, like NASA Astrophysics Data System and PubMed. ProQuest Dissertations & Theses, which likely has most of the Doctoral titles, was sometimes a version, sometimes displayed as separate entries, and sometimes not found by Google Scholar.

Examining these 25 items, most had a version that was another format and/or were on a repository other than OhioLINK or a publisher site. Table 9 gives a count for each type. Note the most cited title was the only item in this group with more than one of these three formats (both a conference paper and a journal article).

Type	# of Titles
------	-------------

Journal Article	12
Conference Paper	2
Book/Chapter	1
Non-OhioLINK/Publisher Repository	16
None of these	5
Undetermined*	1

Table 8: Versions Types Count – Top 25 Cited ETDs

*\*Missing from Google Scholar when trying for closer examination*

Since these titles were mostly counted as versions of other works by Google Scholar, it's extremely likely that these citation counts for these ETDs are inflated. Parsing out true citation rates for each title with such a situation would require examining every citing item to determine which version was cited. The first item, for example, could have its 1076 citations distributed across the ETD, journal article, or conference paper version of the article. It is also possible that freely available items on other on non-OhioLINK repository sites may be a preprint of one of the versions. So determining true citations to an ETD in cases where Google Scholar versions items with the same title and a common author that are not the same item makes finding a true citation count cumbersome; this is especially true for lower-count citation rates and time consuming as the count increases. The citation count in such cases should be deemed inaccurate and it is likely that co-authors of the other formats may be seeing an inflated count since portions of the citation count could be to the single-authored ETD.

Title	Department	Grad Year	Downloads	Degree	Google Scholar Cites	# of Versions	Max # Authors	Journal Article	Conference Paper	Book / Chapter	Non-OhioLINK / Publisher Repository
Stability Analysis of Swarms	Electrical and Computer Engineering	2002	5102	Doctoral	1076	20	2	X	X		X
Short Text Classification in Twitter to Improve Information Filtering	Computer Science and Engineering	2010	23540	Masters	786	11	5		X		X
The Phonetics and Phonology of Korean Prosody	Linguistics	1993	3199	Doctoral	762	10	1			X	X
The effects of the classroom flip on the learning environment: a comparison of learning activity in a traditional classroom and a flip classroom that used an intelligent tutoring system	Educational Studies	2007	34101	Doctoral	421	5	1				X
Root resorption associated with orthodontic tooth movement: A Systematic Review	Dentistry	2009	4679	Masters	375	12	5	X			X
A comparative analysis of energy management strategies for hybrid electric vehicles	Mechanical and Aerospace Engineering	2009	8652	Doctoral	359	17	3	X			X
A theoretical and experimental investigation of modulation sidebands of planetary gear sets	Mechanical and Aerospace Engineering	2009	6489	Doctoral	258	7	2	X			
Bringing automatic stereotyping under control: Implementation intentions as efficient means of thought control	Psychology	2007	2004	Doctoral	214	16	3	X			X
Forming of tailor-welded blanks	Materials Science and Engineering	1994	3875	Doctoral	203	6	2	X			
Toward the design of a computer-based interactive fantasy system	Theatre	1986	2284	Doctoral	200	2	1				
The effects of humor in persuasion*	Psychology	1972	3941	Doctoral	195						
The five-factor model and career self-efficacy: general and domain-specific relationships	Psychology	2006	13056	Doctoral	184	9	2	X			X

Alienation and political apathy	Sociology	1956	2039	Doctoral	147	6	1	<b>X</b>			
A uniform pressure electromagnetic actuator for forming flat sheets	Materials Science and Engineering	2005	4680	Doctoral	127	17	2	<b>X</b>			<b>X</b>
Social capital and political consumerism: a multilevel analysis	Sociology	2006	3391	Masters	120	8	2	<b>X</b>			<b>X</b>
Mechanics and mechanisms of ultrasonic metal welding	Materials Science and Engineering	2004	13538	Doctoral	119	5	1				
A model of school success: instructional leadership, academic press, and student achievement	Educational Studies	2003	43092	Doctoral	117	5	1				<b>X</b>
Mechanisms of corrosion inhibition of AA2024-T3 by vanadates	Materials Science and Engineering	2006	3768	Doctoral	117	12	2	<b>X</b>			<b>X</b>
Dynamic melodic expectancy	Music	2003	2655	Doctoral	117	2	1				
Omega-3 fatty acids effect on wound healing	Nursing	2007	2796	Doctoral	116	17	4	<b>X</b>			<b>X</b>
The conceptual structure of emotional experience in Chinese /	Graduate School	1989	5282	Doctoral	111	4	1				<b>X</b>
Estimation of the standard error and confidence interval of the indirect effect in multiple mediator models	Psychology	2006	3412	Doctoral	110	5	1				
The emergence of distinctive features	Linguistics	2004	2470	Doctoral	106	8	1				<b>X</b>
A Lockean Theory of Intellectual Property	Philosophy	1997	3415	Doctoral	105	6	1				
A criterion-related validity test of selected indicators of musical sophistication using expert ratings	Music	2006	4857	Doctoral	103	6	1				<b>X</b>

Table 9: Top 25 Cited & Versioning

*\*Missing from Google Scholar when trying for closer examination*

## Citations per Download

So do high downloads translate to high citations? Not always. Do low-download numbers mean low citation rates? Not always. Examining the Top 25 Cited ETDs and citations per download (see Table 10), this figure varies widely.

Title	Downloads	Citations	Citations / Downloads
Stability Analysis of Swarms	5102	1076	0.2109
Short Text Classification in Twitter to Improve Information Filtering	23540	786	0.0334
The Phonetics and Phonology of Korean Prosody	3199	762	0.2382
The effects of the classroom flip on the learning environment: a comparison of learning activity in a traditional classroom and a flip classroom that used an intelligent tutoring system	34101	421	0.0123
Root resorption associated with orthodontic tooth movement: A Systematic Review	4679	375	0.0801
A comparative analysis of energy management strategies for hybrid electric vehicles	8652	359	0.0415
A theoretical and experimental investigation of modulation sidebands of planetary gear sets	6489	258	0.0398
Bringing automatic stereotyping under control: Implementation intentions as efficient means of thought control	2004	214	0.1068
Forming of tailor-welded blanks	3875	203	0.0524
Toward the design of a computer-based interactive fantasy system	2284	200	0.0876
The effects of humor in persuasion	3941	195	0.0495
The five-factor model and career self-efficacy: general and domain-specific relationships	13056	184	0.0141
Alienation and political apathy	2039	147	0.0721
A uniform pressure electromagnetic actuator for forming flat sheets	4680	127	0.0271
Social capital and political consumerism: a multilevel analysis	3391	120	0.0354
Mechanics and mechanisms of ultrasonic metal welding	13538	119	0.0088
A model of school success: instructional leadership, academic press, and student achievement	43092	117	0.0027
Mechanisms of corrosion inhibition of AA2024-T3 by vanadates	3768	117	0.0311
Dynamic melodic expectancy	2655	117	0.0441
Omega-3 fatty acids effect on wound healing	2796	116	0.0415
The conceptual structure of emotional experience in Chinese	5282	111	0.0210
Estimation of the standard error and confidence interval of the indirect effect in multiple mediator models	3412	110	0.0322
The emergence of distinctive features	2470	106	0.0429
A Lockean Theory of Intellectual Property	3415	105	0.0307
A criterion-related validity test of selected indicators of musical sophistication using expert ratings	4857	103	0.0212

Table 10: Citations per Download, Top 25 Cited Titles

Note the most cited title has only 4-digit downloads, lower than many others in this list. This title ranked 712 out of 2,899 in terms of downloads from the studied list (also out of all 51,375 titles). Meanwhile, some much higher downloaded ETDs saw very low citation rates. For example, ETD *Brecker's Blues: transcription and theoretical analysis of six selected improvised blues solos by jazz saxophonist Michael Brecker* had 62,376 downloads but only two citations. *An Illustrated Basic Flute Repair Manual for Professionals* had 135,545 downloads and *Robust Bayes in Hierarchical Modeling and Empirical Bayes Analysis in Multivariate Estimation* had 82,584 downloads, but neither had citations. Several 5-digit download titles had no citations among the 2,899 titles. While there could be many reasons for the downloads, use in the scholarly literature does not always appear to be a result.

However, given some of the findings about Google Scholar's faulty citation count, it seems likely that at least some downloads may be due to title/author matches for items that are in other formats that are not always freely available. It is possible some people are downloading the ETD either mistakenly believing it to be the same item as a journal article, book, or conference paper or else are going with the closest item they can get for free given that many of the items were available via proprietary publishers.

## **Future Studies**

An examination of the citation rates of all ETDs would be nice. It is entirely possible that some lower-cited ETDs would have high citation rates. Examining the 2,899 titles that constitute 50% of downloads is just a snapshot and given that there are 51,375 entries in the data set, this subset is only 5.64% of the titles. However, examining this large number of titles would require a lengthy amount of time identifying titles in Google Scholar and recording cite counts. However, a more extensive look at the dataset could better find trends and interesting findings. For example, some data gathered from remaining titles thus far reveals a title with only 42 downloads, but 26 citations (although it also falls under the category of having other versions that are not the same item, in this case a journal article). A future desired long-term project will be to gather this data.

## **Conclusions**

The data collected on these ETDs shows that download rates of the ETDs does not always correspond to high citation rates. Some titles with very high download rates had no citations and some with much lower had quite high citation rates. A good number of ETDs had citation rates over 100, with one over 1,000. Many departments, constituting varying disciplines, had quite high average citation rates for their ETDs. Titles from the 1990s tended to have the highest average citation rate, although they of course have had more time to get cited. These would have been added to the OhioLINK ETD Center at a later date as digitized versions of the paper thesis or dissertation.



Unfortunately, it was found that this information came with a big caveat. Google Scholar too often combines ETDs with other formats (articles, books, conferences papers) with the same title as long as the ETD author was *at least one of the authors*. In many of these cases, the other format had more than one author. Hence, the items could not be exactly the same item and thus the citation count for the ETDs were, in many cases, flawed. Google Scholar does not give a breakdown of the citation count, meaning the citation number is likely inflated for the ETD as these other formats tend to be more popular. This also means that authors of the other formats may be getting more citations in their counts than deserved since some of the citations could be to the ETD, for which they are not listed as an author.

In other words, unless Google Scholar has a totally separate record for an ETD that is not listed as a version of another format, any citation rate gathered on a given title is likely highly inflated from its true rate. Without digging into citing titles to determine which item was cited, it would be impossible in such cases to clearly indicate the true citation rate of such ETDs using Google Scholar.

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