

## **Determining the Level of Commitment to Research Ethics in Terms of Citation Accuracy and Correctness in University Theses and Dissertations**

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Received: 28 August 2020

Accepted: 15 August 2021

### **Abstract**

This study aimed to determine the level of commitment to research ethics regarding the accuracy and correctness of citations in the reference list of theses and dissertations at Ahvaz Jundishapur University of Medical Sciences. The study is comparative in method, and purpose-wise it is applied. The statistical sample comprised of 1012 theses and dissertations by Master, MD, and Ph.D. graduates during 2015-16. The sampling method was “random stratified” with a volume of 5%. Two researcher-made checklists were used to collect data, which were analyzed using descriptive and analytical statistics. Findings show an average of 66 citations in each thesis or dissertation. The minimum and the maximum number of citations in a thesis/dissertation were 11 and 183, respectively. Out of the total 3339 studied citations, 165 citations (4.9%) were not retrieved; 214 citations (6.4%) were identified as duplicates; 1322 citations (39.59%) had various errors, and no faults were identified with the other 1644 (49.05%) citations. Findings indicate that the examined theses/dissertations were acceptable in terms of citation correctness during the studied period but had a less desirable status regarding citation accuracy.

**Keywords:** research ethics, citation correctness, citation accuracy, thesis/dissertation, Ahvaz Jundishapur University of Medical Sciences

### Introduction

Research ethics is a field of applied ethics that controls researcher behavior over the whole research process, including collection, analysis, reporting data and the publication of results (Research Ethics, 2020). One of the main aspects of research ethics is the principle of remaining trustworthy when citing the sources used by the researcher in planning, executing, and publication of his research results (Salehi, Ghani-Dehkordi, Parvin, Nekoei-Ghahfarokhi, Rafiei-Vardanjani & Kianpour, 2014). Nowadays, with the prevalence of the copyright law, no one can deny the significance of citation in academic works; that's the reason for rejection of research papers, projects, or even theses/dissertations (=T/Ds) due to scientific plagiarism or violation of principles of citation trustworthiness, even after getting reviewed, refereed, accepted or published. Of important factors in each citation are correctness and accuracy. Citation to other research papers could be used for various purposes, including to show the position of research and its subject among the related research works, to highlight its relevance to other research, to review the research background in the field under study, to identify research tools and methodology, to confirm or reject a research's results, to evaluate previous research, to document the data and findings of the research, etc. (Davaranah, 2005; Salehi et al., 2014). So it is crucial to have accurate citations in research papers; if research is not based on correct and accurate citations, i.e., if it lacks citation correctness, not only will the results and findings not be reliable but could have irreparable consequences.

Accuracy of citation and correct bibliographical information of cited documents are equally important because citations act as a bridge between the citing paper and cited documents and help the reader retrieve cited documents and related literature (Horri & Shahbodaghi, 2009). The more accurate bibliographic information in a citation, the easier the search of cited document, and the less time and cost in retrieving that document. Furthermore, research accreditation requires having accurate citations since citation accuracy could show the credibility of the research, among others.

Writing a T/D is usually one of the preliminary efforts of students in academic research. In most cases, each leads to extracting at least one article based on that T/D. Suppose a T/D includes correct and accurate citations. In that case, the extracted paper will be more reliable, and in case of getting published, users and the audience will be able to retrieve cited sources in the article with less time and cost. On the other hand, inaccurate citation and bibliographic information of the cited document in the reference list will cause intellectual loss to the author of the cited document, mainly when validating and refereeing the T/D, making it complex and sometimes difficult impossible for referees to track the cited document. Besides, inaccurate citation in any research may be interpreted as "scientific plagiarism" and unintentional identification of the researcher as a "scientific plagiarist", which will have damaging impacts on the researcher and his respective organization. Because citations are important tools in citation analysis", analysts will face challenges when analyzing citations if they are inaccurate and correct (Horri & Shahbodaghi, 2009).

### Background

When reviewing the background for the present research and searching well-known domestic and international databases, the focus was on those findings with more subjective relevance to current research, including:

Some (e.g. Azadeh, Vaez & Gharib, 2009; Azadeh & Vaez, 2012; Salehi et al., 2014;

Zarei, 2014) have highlighted citation errors in the reference list the T/Ds by Medical Sciences students at different levels. Others (e.g. Rahmani, 2016; Al-Benna, Rajgarhia, Ahmed & Sheikh, 2009; Adhikari & Acharya, 2010; O'Connor, Lukin, Eriksson & O'Connor, 2013; Samad, Khandadeh, Kumar & Malik, 2013) also studied citation errors in the reference list of articles which were published in the scientific-research magazines in various medical fields.

In their research, Van Eck & Waltman (2019) checked the accuracy of citation data in two major multidisciplinary bibliographic databases: Web of Science and Scopus. Reviewing studies mainly on citation analysis reveals that despite focusing on citation accuracy and correctness in Iran and the world, T/Ds and magazines reviewed for quotations or citations accuracy and correctness still seem to lack ideal and desirable ratios. However, a few pieces of research (like Rahmani, 2016) have shown the status of citation accuracy and correctness as acceptable. In previous research on this subject, differences between irretrievable and inaccurate retrievable citations have been highlighted. However, the results do not indicate the amounts of irretrievable citations. This research examines these factors based on two separate variables.

### **Research Methodology**

Current research is comparative in method and applied in purpose. The statistical sample comprised T/Ds by Master, MD, and Ph.D. graduates passed during 2015 and 2016. Sampling was conducted through a random stratified method with a volume of 5% (=50 titles) of 1012 T/Ds available in the central library of Ahvaz Jundishapur University of Medical Sciences. To do so, the T/Ds of each year were classified into three groups based on graduation grades, and each T/D was given a specific code. Then, a total sample of 50 was selected according to the volume of T/Ds in each year and class (grade), out of which 26 T/Ds (=52%) belonged to 2015 and 24 T/Ds (=48%) to 2016. 42% of examined T/Ds came from MD, 38% from Master, and 20% from Ph.D. graduates.

The data were gathered with two researcher-made checklists, which were prepared according to the aim and questions of the research and based on the checklist used in Rahmani's (2016) research. Upon completion of sampling, T/Ds data were extracted by filling up the first checklist for each T/D. Then to fulfill the second checklist, the information of citations in each T/D was extracted. At first, the correctness of cited documents was verified by searching in reliable databases.

Each citation, which was verified for correctness, was then checked for the accuracy of bibliographic information. For this purpose, bibliographic information within the citation was compared to the original document or those on the reliable bibliographical databases. At this stage, citation errors were divided into minor and major errors based on the impact on the retrieval of the cited document. Descriptive statistics, including frequency, average, standard error, and percentage, were used to analyze and interpret the data. Inferential statistics methods including the Chi-Square Test and ANOVA were used to compare the ratios and evaluation of relations between variables. SPSS was utilized to analyze the data.

### **Findings**

The sample was comprised of 50 T/Ds, and all citations available in the reference list of the sample, containing 3339 citations, were checked for accuracy and correctness. The

average number of citations in each T/D was 66. The minimum and the maximum number of citations in a T/D were 11 and 183, respectively. Out of 3339 examined citations, 165 (4.9%) were not retrievable, and 214 (6.4%) were duplicates removed while checking for citation accuracy and correctness. 1322 (39.59%) had citation errors, and 1644 citations (49.05%) had no errors at all. Table 1 shows the frequency of error types with citations, divided based on the document type.

As seen in Table 1, the maximum number of errors comes from articles (37.344 %), and the minimum number is related to web pages (0.448%) and T/Ds (0.64%).

Table 1

*Frequency of Citation Errors based on the Type of Cited Document*

Type of citation errors	Type of cited document											
	Article		Book		Web page		T/Ds		unspecified		total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Minor	867	27.74	183	5.85	9	0.28	16	0.51	37	1.18	1112	35.58
Major	300	9.60	58	1.85	5	0.16	4	0.12	2	0.06	369	11.80
With no errors	1495	47.84	115	3.68	12	0.38	12	0.38	10	0.32	1644	52.60
total	2662	85.18	356	11.39	26	0.83	32	1.02	49	1.56	3125	100

**The amount of accuracy and correctness in citations within the T/Ds**

Table 2 shows the citation accuracy and correctness level in examined T/Ds, separated by the defense date.

Table 2

*Level of Accuracy and Correctness in Examined T/Ds Based on their Defense Date*

Citation correctness Date Of Defense	Level of citation correctness			t-test (P-Value)	Level of citation accuracy			t-test (P-Value)
	frequency	Average %	Standard deviation %		frequency	Average %	Standard deviation %	
2015	26	96.00	4.00	0.0001	26	47.00	21.00	0.0001
2016	24	96.00	4.00		24	52.00	17.00	
Total	50	96.00	4.00		50	49.00	19.00	

According to the results, the level of citations correctness in the examined T/Ds is at average  $96 \pm 4$  %. The maximum and minimum citation accuracy in the examined T/Ds are 100 and 83 percent, respectively. Statistical test performed on the mean difference of citations accuracy, based on defense date, ( $P = 0.0001$ ) indicates a significant difference (at the level of 0.05) between the level of citations accuracy in the examined T/Ds according to the defense date. According to tables 1 and 2, T/Ds defended during 2016 have a slightly better

citation accuracy.

Also, according to the results, the average level of citations accuracy in examined T/Ds is equal to  $49 \pm 19\%$ . In the meantime, the maximum and minimum levels of citations accuracy in the examined sample were equal to 81 and 0 percent, respectively. The statistical test results on the mean difference of citation accuracy based on defense date ( $P = 0.0001$ ) show a significant difference (at the level of 0.05) between the level of citation accuracy in the examined T/Ds according to their defense date. As per table 2, T/Ds defended in 2016 have a better citation accuracy with an average of 52%.

**Examining the presence of a significant difference between citation accuracy and correctness levels as per the main researcher’s educational grade**

The average level of citations accuracy and correctness in examined T/Ds based on the main researcher’s educational grade has been provided in Table 3.

Table 3  
*Level of Citation Accuracy in Examined T/Ds as per Researcher’s Grade*

Citation accuracy Researcher’s grade	Level of citation correctness			ANOVA Test (P-Value)	Level of citation accuracy		ANOVA Test (P-Value)
	frequency	Average %	Standard error %		Average %	Standard error %	
Master	19	95.00	4.00	0.0001	54.00	16.00	0.0001
MD	21	96.00	4.00		45.00	20.00	
PhD	10	98.00	2.00		50.00	26.00	
Total	50	96.00	4.00		49.00	20.00	

Results from Table 3 and those of statistical tests performed on citation correctness, as per the main researcher’s educational grade ( $P = 0.0001$ ), indicate a significant difference between the average level of citation correctness in examined T/Ds based on the main researcher’s educational grade. Accordingly, Ph.D. dissertations had a better situation with  $98 \pm 2\%$  citation accuracy. Also, findings from Table 3 and results from the statistical test ( $P = 0.0001$ ) compared the average level of citation accuracy per the main researcher’s educational grade show a significant difference in citation accuracy of average studied groups. According to this, theses of Master's degree grades, with an average of  $54 \pm 16$ , are better positioned.

**Examining the significant relationship between the level of citations accuracy and correctness with the type of cited document**

Table 4 evaluates the citation accuracy and correctness frequency by the cited documents in the examined citations. To check the presence of any relations between the variable of correctness and the type of cited document, a statistical test was performed over the examined citations and, as per Table 4, results indicate a significant relationship (at the level of 0.05) between the correctness of citations and the type of cited document ( $P = 0.0001$ ).

Table 4

*Frequency of Citation Accuracy and Correctness by the Type of Cited Document*

Citation correctness		Type of document	Type of cited document				Chi-Squared test (P-Value)
			Article	Book	Other	total	
Yes	Frequency		2583	308	69	2960	0.0001
	Frequency % in group		82.656	9.856	2.208	94.720	
No	Frequency		79	48	38	165	
	Frequency % in group		2.528	1.536	1.216	5.28	
Total	Frequency		2662	356	107	3125	
	Frequency % in group		85.184	11.392	3.424	100	
Yes	Frequency		1489	115	34	1638	0.0001
	Frequency % in group		49.750	3.842	1.135	54.727	
No	Frequency		1120	194	41	1355	
	Frequency % in group		37.420	6.481	1.369	45.271	
Total	Frequency		2609	309	75	2993	
	Frequency % in group		87.170	10.324	2.506	100	

Also, with regards to the evaluation of the relationship between the variable of accuracy and type of cited document, a statistical test was performed over the examined citations and, as per table 5, results indicated a significant relationship (at the level of 0.05) between the citations accuracy and the type of cited document ( $P. = 0.0001$ ). According to Table 4, the maximum number of errors by the cited documents is for cited articles.

### **Examining the significant relationship between the level of citations accuracy and correctness with the language of cited documents**

Table 5 shows the frequency of citation accuracy and correctness by the language of the cited document in the examined citations. To evaluate the relationship between the variable of correctness and language of cited document, a statistical test was performed over the citations and, according to table 5, results indicated a significant relationship (at the level of 0.05) between correctness and the language of the cited document ( $P. = 0.0001$ ).

Table 5

*Frequency of Citations Accuracy and Correctness by the Language of the Cited Document*

Citation correctness		Language of document	language of cited document				Chi-Squared test (P-Value)
			English	Persian	Other	total	
Yes	Frequency		2570	361	29	2960	0.0001
	Frequency % in group		3.125	11.552	0.928	94.720	
No	Frequency		75	48	42	165	
	Frequency % in group		2.4	1.536	1.344	5.28	
Total	Frequency		2645	409	71	3125	
	Frequency % in group		84.64	13.088	2.272	100	

Language of document		language of cited document				Chi-Squared test (P-Value)
		English	Persian	Other	total	
Yes	Frequency	1500	123	15	1638	0.0001
	Frequency % in group	50.12	4.11	0.50	54.73	
No	Frequency	1094	244	17	1355	
	Frequency % in group	36.55	8.15	0.57	45.27	
Total	Frequency	2594	367	32	2993	
	Frequency % in group	86.67	12.26	1.07	100	

Besides, to check the relationship between the variable of accuracy and the language of cited document, a statistical test was conducted over the citations and, as per table 5, results showed a significant relationship (at the level of 0.05) between accuracy and the language of the cited document (P. = 0.0001). According to Table 5, the maximum number of errors by the language of cited documents refers to the English language. However, the ratio of inaccurate citations to Persian documents is two times that of accurate citations.

### Discussion

Current research indicates that T/Ds defended at Ahvaz Jundishapur University of Medical Sciences during 2015-16 in different educational grades have a good position with an average of 96% citation correctness. However, the status is less desirable regarding citation accuracy (average of 49%). The statistical test results in current research show the statistically significant difference between variables of correctness and accuracy by the grade of the main researcher's educational grade, which is different from the findings of a research by Salehi et al. 2014. Also, based on a comparison of the total average of citation accuracy (49%) and that of Ph.D. grade (50%) in this research against the research by Azadeh and Vaez (47.26%) and Azadeh, Vaez and Gharib (38.09%), it seems that T/Ds at Ahvaz Jundishapur University of Medical sciences have better citation accuracy than those mentioned above (Azadeh & Vaez, 2012; Azadeh, Vaez & Gharib, 2009).

Concerning the significant difference between the level of citation accuracy and correctness by the researcher's educational grade, current research results were not aligned with Salehi et al. (2014). In this research, although the T/Ds examined in terms of citation accuracy had better rankings with a total average of 96% in all education grades, Ph.D. dissertations with an average of 98% were much better than the other two groups. Also, regarding citation accuracy, the difference between the average of two groups having minimum and maximum levels of citation accuracy is 9% which, as per the statistical test results, indicates a statistically significant difference among the average of the groups. In our research, theses of the master's degree level are of a better situation in the sense of citation accuracy, with an average of 54.

Regarding the existence of a statistically significant relationship between the level of citation accuracy and the type of cited document, current research results are aligned with those from Rahmani's (2016). In the current research findings, the maximum number of errors is related to cited articles, which is fairly significant due to the high number of citations to such sources in student T/Ds. Following the articles, cited books get second place with a

doubled rate of errors compared to accurate citations. It should, of course, be noted that the citation accuracy of cited books is much higher than cited articles.

Considering the existence of a statistically significant relationship between the level of citations accuracy and the language of the cited document, the results of current research agree with Rahmani (2016) that concluded Persian documents were better than citations to non-Persian documents. Still, in this research, as mentioned earlier, the maximum number of errors by the language of cited documents are related to English documents. However, the ratio of inaccurate citations to Persian documents is almost two times more than accurate ones. The citation accuracy of Persian documents is also higher than that of English documents.

### Conclusion

Based on the findings from current research, and comparing them with the results of previous research, it appears that T/Ds at Ahvaz Jundishapur University of Medical Sciences from all three studied grades have desirable status in terms of citations correctness; however, they are not in an acceptable form in the sense of citations accuracy, which could be due to some education weaknesses. This shows that in terms of moral principles, respect for intellectual property, and copyright of the authors of scientific works, students have avoided forging the source and reference in the form of fake reference entries in their T/Ds.

On the other hand, a low degree of citation accuracy indicates inefficiencies from an educational aspect. Providing information literacy skills training, especially that part of those skills concerning information documentation and producing new information products, should focus on educational planners. It is necessary to emphasize the importance of accuracy in a citation in the relevant workshops.

One factor that increases the accuracy of citation is using reference manager software. But one of the factors that prevent the full use of these software features is inadequate training and the language barrier. Therefore, it is recommended to provide workshops on using reference manager software. Regarding the language barrier, it is recommended that students get prepared to use the original versions of reference manager software for undergraduates by using the translated / non-English versions of reference manager software.

It is also observed that users do not have access to all software features due to the use of cracked versions of some software, which violates copyright and research ethics. Therefore, it is recommended that decision-makers take the necessary action to ensure legitimate and legal access to this software, and in cases where for any reason it is not possible to pay for the reference manager software, use software (such as Mendeley and Zotero) that are legally free to use.

### Appreciation

This research is retrieved from the results of a Master's degree thesis under project number U-96080, and its relevant costs have been covered by Ahvaz Jundishapur University of Medical Sciences.

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