

# Writing scientific thesis/dissertation in biology field: Problem of conclusion writing

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## Abstract:

A conclusion chapter is written at the end of thesis or dissertation by postgraduate students to express the meaning of results. The conclusion text should be written according to the most acceptable standard guidelines for scientific writing. Conclusions must be written in clear, concise, fully supported by the results obtained, based on fact and logic, and far from exaggeration or speculation. This project included studying and analyzing of the conclusion chapter text in 124 written theses and dissertations by postgraduate students (master and doctor of philosophy) in biological sciences from different Faculties and different Departments. The study also involved interviewing 114 postgraduate students from those fields to obtain their opinion about how to write a conclusion text. All students of both degrees wrote their conclusion in separated numbered statements and no conclusion written in paragraphs. Almost all students tended to repeat all their results in short sentences without any innovation comments. All students showed significant lack in conclusion writing knowledge and they hadn't any idea about how to write a conclusion text; they just wrote the conclusion chapter in order to fulfill the requirements or obtaining the degree. Almost all students neither tried to read any article or guidelines for how to write a conclusion chapter nor took specific course for writing process in their curriculum. Students tried to mimic the writing style of previous graduate students regardless of that writing style was correct or not. The study concludes that almost all postgraduate students have no knowledge or skill in scientific writing process especially in conclusion text writing. Therefore, it is strongly recommended to re-evaluate the postgraduate curriculum in order to involve courses that can improve the level scientific writing of theses or dissertations.

**keyword:** *Writing scientific, thesis, conclusion.*

## Introduction:

Although there is no one unique definite universal writing style for a scientific articles or theses/dissertations, most of them may be organized into sections or chapters including abstract, introduction, methods, results, discussion, conclusion and recommendations and reference(1; 2). The main purpose for writing an article and thesis or dissertation is to put the achievements of a research work between the hands of other researchers or readers as an easy communication tool. The researchers should find the best tool to convey their findings to the readers, if not; the whole communication system for scientific media will face threats and will not serve the scientific progression correctly (3). Therefore, the writing system should follow specific instructions to achieve that purpose success-

fully and honestly.

The conclusion section represents the last part that audience read; therefore it must leave good, nice and deep impression about the research work as it represents the last chance to convince the reader. It should have the answer to questions or hypothesis that has been raised in the introduction and aim of study (4); hence the effective conclusion must answer these questions clearly and precisely but far from suppositions or speculations. Moreover, the conclusion must not restate purposes or major findings (5), instead the conclusion should put the research in perspective by a way that can add new knowledge, open new doors for further work in a specific area and add a motive for further thoughts for future development (4; 6). Therefore the conclusion should depend on findings presented and restricted on their borders, and should written in brief, concise, and informative style based on the findings in order to demonstrate the gain in knowledge made from entire research contents (6). Accordingly, the conclusion can be illustrated as a final touch at the end of a great work in order to

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prepare research paper or thesis/dissertation finale.

There are voluminous published articles about research writing styles worldwide, and all of them undertake the whole requirements for article writing in order to improve writing process to fulfill readers' needs. However, the research work on the conclusion writing style has not received considerable attention as few articles have been published elsewhere about the conclusion writing problems (7; 8; 5; 9; 4). Almost all those studies have focused on the ideal style to write the conclusion chapter in articles or in thesis/dissertation (TD). Most international Universities tend to submit their instructions and comments about conclusion writing style either in a text book (10;11) or on their websites (websites references) but not in a separated published paper. However, the scientific media particularly in developing countries strongly need such type of article to ameliorate their writing level to produce well accepted conclusions. Generally, all published research articles and comments on conclusion section confirm the need to pay high attention on the conclusion writing process to offer the philosophy of the research work in a way that can provoke further opinions for future work (12).

Writing style for theses/dissertations (TDs) in Iraq was organized by specific instructions issued by the Ministry of Higher Education and Scientific Research based on the most international writing styles such as United Nations Educational, Scientific and Cultural Organization (UNESCO) instructions (13;14) and others (15). During the last two decades, the number of Universities has been markedly increased in Iraq and the number of postgraduate students has been increased as well. This has been accompanied by gradual ignorance the original thesis/dissertation writing instructions. Previous studies on a large sample of postgraduate students' TDs from different Iraqi University (16;17; 18) revealed that most TDs were written in styles that not compatible with the style fixed by original instructions. Those studies found that the majority of postgraduate students have no clear idea about styles of TD writing; much variation can be demonstrated among students even in the same University. This problem extends to involve even grammar and linguistic errors in the thesis/dissertation text (19). A conclusion section must be written in the end of any scientific thesis/dissertation especially in biological sciences. This study expects to find significant deviation and variation in writing this section by the postgraduate students even in the same Department. Therefore this study was designed to assess the situation of conclusion writing style among biological sciences thesis/dissertation written in English in different Iraqi Universities.

## Methods:

### Thesis and dissertation study

Reference writing process was carefully studied in 124 TDs in the field of biology which included medicine, biological sciences, veterinary medicine, pharmacy, dentistry, agriculture and other minor related branches.

The present work was performed at the Iraqi Centre for Can-

cer and Medical Genetics Research (ICCMGR) through two processes. Firstly, the study involved careful reading and analyzing of 124 TDs of postgraduate students (both master and doctor of philosophy) in the field of biology (including medicine, dentistry, veterinary medicine, pharmacy, agriculture and biology) for a period of five years (from 2007 to 2012). Secondly, further work was done by interviewing 114 postgraduate students who finished their TDs writing in the ICCMGR from different biological disciplines.

The conclusion chapter was studied and analyzed carefully and then criticised according to the most international used standard guidelines for scientific writing (4;5;8;9;13;14;15). Every conclusion text was read and argued with what written in both the introduction and the results chapters.

### Interview study

The study involved interviewing 114 postgraduate students (master and PhD) from different Departments and Colleges as mentioned above. The interview was documented with only students who accepted to do this process and answer all questions.

The questions during the interview were as follow:-

What is the conclusion chapter and why you are write conclusion in your thesis/dissertation?

Do you know the standard guideline for writing a conclusion in the thesis/dissertation?

Have you got any idea about the main essentials involved in a conclusion text?

Have you ever read some articles about how to write a conclusion chapter?

What is the rank can you give to the conclusion chapter among other chapters according to their importance?

What are the differences between the conclusion and the results in your thesis or dissertation?

## Results:

### Thesis and dissertation study

All Iraqi postgraduates students type their theses or dissertations by using A4 size paper, therefore when the term page used in this article, it means A4 size page.

Among the 124 TDs, 17 (13.7%) TDs showed the size of conclusion text occupied up to a half page, 71 (57.3%) TDs written in a full page and 34 (27.4%) TDs were written in two pages while two TDs occupied three pages (Table 1)

Table1. The size of conclusion text occupied by pages in 114 postgraduate student's theses or dissertations

Number of TDs (124)	Number of pages	Percentage %
17	Half page	13.7
71	Full page	57.3
34	Two pages	27.4
2	Three pages	1.6
Total: 124		

The conclusion text in all TDs was not written in paragraphs or cohesive sentences rather they were written as a list of points by using separated statements, each statement started with number. The number of statements varied from five to 17, however the majority of conclusion sections contained between six to nine statements.

Almost all conclusion sections were written in a pattern that students repeat their results in short summarized sentences. Moreover no TD showed correct conclusion writing style. The number of statements in the conclusion section depended on the size of the results on the TD. In addition to that, most students tended to generalize their results in the conclusion section by magnify or minify the result echo depending on what the students bears in his/her mind. This is confirmed by notion that the statistical significance was shown to be not mentioned in most TDs conclusion section.

Thirty seven (30%) TDs exhibited recommendation statements within the conclusion text as they referred for future work. In another hand 42 TDs (34%) included findings not mentioned in the main aims of the project, while nine TDs showed new results not found in the result chapter.

The conclusions in all TDs were written in an independent manner of the main aims of the TDs and the conclusion did not show clear concordance with to the hypothesis raised in the introduction. Most TDs revealed conclusion points more than that required in the main aim points.

All above results showed no marked differences in conclusion writing errors between theses and dissertations for all students.

#### Interviewing study

One hundred and fourteen postgraduate students agreed to be interviewed concerning their knowledge about conclusion writing style. Concerning the definition of conclusion chapter, all students gave similar answers as they said that conclusion chapter is a chapter to list the main results of the TDs in summarized numbered sentences. The students wrote the conclusion chapter because it is one of the requirements for TDs writing according to the instructions of the University to get their degree; this was the answer of all students. All students answered that they do not know anything about the standard guidelines for writing a conclusion text. Moreover they showed no any idea about the main essentials that involved in the conclusion text. No one tried to read an article about how to write conclusion text. The TDs contain nine chapters

(abstract, introduction, literatures review, methods, results, discussion, conclusion, recommendation and references); concerning the rank of conclusion chapter in the TDs, 43 (37.7%) students put the conclusion chapter in the bottom of the list, 19 (16.7%) students put the conclusion chapter in the sixth rank, 36 (31.6%) students in the fifth rank, six (5.3%) students in the fourth rank, eight (7%) students in the third rank, and only two (1.7%) students in the second rank after abstract chapter. However, the students were unable to give answer about the main criteria that they used to put the conclusion chapter in such ranks. Regarding the last question, all students agreed that the conclusion chapter is just a summary to the results but written in short statements to make it easy for readers to read the results.

#### Discussion:

This study reveals that most postgraduate students write their TDs without previous knowledge about the guidelines of TDs writing styles. The results from TDs analysis showed that all students wrote their conclusion at the end of the TDs in many separated numbered statements, no one of them tried to write the conclusion text in coherence statements in one or two related paragraphs. The process of conclusion writing as the students think is to restate the results in short summarized sentences to facilitate understanding the results and to make them more readable. Most studies referred to this problem and advised students or researcher not to restate the results (5). The concept of conclusion writing style is completely absent with those students indicating that postgraduate studies need more attention and more follow up to be improved to create educated students who gain considerable knowledge about scientific writing process.

The size of conclusion text varied from a half page to three pages, just in 14% of the TDs the conclusion text was written in a half page while about 29% of them showed two to three pages and in 57% of the TDs the conclusion text was written in a full page. It is clear that the students tend to repeat all their findings in the result chapter and rewrite them in conclusion chapter in short statements. The students did bear in their mind wrong idea about the value of conclusion chapter; they just thought it is a summary of the result chapter only. This was confirmed by interviewing up to 114 students, they showed zero knowledge about the meaning and the value of

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conclusion chapter. Most Universities and universal scientific writing style instructions recommended to write conclusion text in concise and short statements with one or two paragraphs but not in long text that repeat the findings (5, 11, 9, 20-25).

The frustrating situation of conclusion writing was clearly manifested in 30% of TDs in which recommendation statements for future work were reported with the conclusion points. The situation became worse when 34% of students added findings not required or not mentioned in the main aims of their project and 7% of them fixed new findings that did not stated in the result chapter at all. These situations reflect a serious problem about the thinking style of the students indicating that postgraduate students definitely possess deficiency in conclusion writing process. It appears that some of those students tend to fall in an exaggeration state by overstate their findings by adding further results probably they thought these results axiomatically were derived from their original results or they thought that recommendation statements be considered as modulated results can be added with no fear with conclusion text. Whatever the student's interpretation was, the resultant indicates that the postgraduate students showed floundering conditions in their writing style. They pay no attention to the principles of conclusion writing guidelines rather they just inherit their writing knowledge from previous graduated students even the latter were wrong in their writing style. This is indorsed by the findings that postgraduate students tended to write their conclusions point independent of the project aims or hypothesis. The students just focused on what they found in their results in a way as they have no aims in their TDs. The conclusion text should be drawn from the findings and demonstrate the significant of the work far from exaggeration and far from deviation from the original aims (11, websites). Adding new results in the conclusion will mislead the reader and give incorrect impression about the importance of the work and this will lead to weaken the project and make the reader ignoring it completely.

The overall answers of students during the interviewing indicate that most if not all postgraduate students in biological sciences do not understand the moral of fable, significance and reason of conclusion writing in their TDs. They are even tried to read any article about scientific writing principles. They write their conclusion chapter just to fulfill the requirements for obtaining their degree. This situation extends to involve many other chapters in the TDs as mentioned by other studies (16-19). These studies found that postgraduate students in biological sciences revealed sever deficiency in the knowledge of scientific writing principles. Most students find it is easy to follow the previous TDs writing style without making sure if that writing style was right or wrong. Any first look for the TDs will obviously give that impression as all TDs follow almost the same style for conclusion writing even some grammar or language mistakes were show to be copied without correction from one TD to another.

The findings of this study revealed that postgraduate students severely lack the ability to understand the principle of writing conclusion genre properly. If those students are subjected to educational courses in this field, the writing process

will be improved to a level that they can be considered as good scientific researchers. Several studies and universities' instructions (13-15; 7; 5;8; 9; 4; 6; 20-25 ) agreed to recommend the proper way to write conclusion chapter. Every researcher or student must know that the conclusion means what are the main findings and opinions that can be made from the over-all observations. The student must refer back to the problem aims in order to describe the conclusions that were gained from performing this project, and summarize new ideas, new interpretations, and new understandings that have resulted from the project. This will lead to know the significance of the conclusion with regard to the problem that was tried to solve. The conclusion chapter should express the logical results of the research. Even if the results differed from the original hypothesis, the conclusion must be written based upon what was found by the scientific method. It needs to remind the reader with the original hypothesis in the first part of the conclusion and to reiterate the aspects of introduction chapter to refresh the reader's memory of what was set about to prove with the research. The researchers have to explain the importance of the project indirectly by referring to the importance of the findings and the powerful of the future studies. This must be done cleverly in order to instill in the reader a sense of relevance. However the student must pay hard effort to show the originality of the conclusion points even some of the findings are similar to others. Every student performs the projects by using specific methods in a specific time and place, therefore it is not difficult to extract new observations and put new findings for any projects to refer to the originality of the work.

The most important point in the conclusion is the trial of the student to highlight uniqueness things that have been done or observed. The student should show which part of the research methodology gave the most fruitful results and what aspect of the methodology gave the most accurate results. Furthermore The student should focus on what kind of advice to give for other researchers to avoid or follow specific methods, and to put an answer if there are specific areas require further explorations of the topic and further study and how can new research methods compare to old research methods. This will clarify that the purpose of the conclusion is to reveal what researchers have learned from the research and to provide the researcher own insight and opinion. Construction a thoughtful conclusion from the points made in the essay is the most vital point that should be raised in conclusion text.

Although the student usually needs to prove the project hypothesis correct, but in the science this trend is not well accepted because obtained results always judge the final situation. The conclusion chapter must put the answer for the questions raised in the introduction chapter and forms an echo for the aims and hypothesis. However the students have to focus a bit at the end of the conclusion points because a good last sentence will leave the reader with something to think about. Clever way is required to state what a student wants the reader to do or think and to avoid making the conclusion too long. An effective conclusion should be abstracted to reach the point, one or two paragraphs is sufficient and should be concise and short yet express all the necessary data resulting from the

study. (26; 10, 1999, 8;5; 11, 20-25).

From this study it is concluded that almost all postgraduate students severely lack skill and knowledge in how to write research articles or TDs. They mostly do not know the significant and justification of writing most TD chapters rather they tend to follow their previous graduated students who finished their studies even they were wrote their TDs improperly. It seems that the most important goal of the students is to ob-

tain the degree regardless of what they acquired from their studies regarding writing style. Therefore this study strongly recommends to re-evaluate the postgraduate studies programs and curriculums and focusing on learning process rather than teaching process to elevate the level of postgraduate students in science writing process through following the most acceptable guidelines for research writing.

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# كتابة الرسائل والاطارح في علوم الحياة: مشكلة كتابة الاستنتاج

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## الخلاصة:

يكتب فصل الاستنتاجات من قبل طلبة الدراسات العليا في نهاية الاطروحة او الرسالة لتعبر عن معنى النتائج. يجب ان يكتب محتوى الاستنتاجات استنادا الى التعليمات القياسية المتعارف عليها للكتابة العلمية. يجب ان تكتب الاستنتاجات بشكل واضح ودقيق مدعومة بالنتائج التي تم الحصول عليها ومستندة الى الحقائق والمنطق وبعيدة عن المبالغة والتخمين. شمل هذا البحث على دراسة وتحليل فصل الاستنتاجات في 124 اطروحة ورسالة لطلبة الدراسات العليا (ماجستير ودكتوراه) في العلوم الحياتية في كليات واقسام مختلفة. كذلك شملت الدراسة على اجراء مقابلة مع 114 طالب دراسات عليا من تلك الاختصاصات لمعرفة آرائهم بكيفية كتابة محتوى الاستنتاجات. كل الطلبة من كلتا الدرجتين كتبوا محتوى الاستنتاجات بهيئة نقاط مرقمة ومنفصلة عن بعض ولا يوجد اية استنتاج مكتوب بهيئة فقرات متسلسلة. يميل كل الطلبة على الاغلب الى اعادة كتابة كل النتائج ولكن بشكل جمل قصيرة بدون اي ملاحظات ابداعية. ابدى كل الطلبة نقضا كبيرا في معرفة ومهارة كتابة الاستنتاجات حيث تبين انهم يكتبون فصل الاستنتاجات لاجل اكمال متطلبات نيل الدرجة العلمية فقط. على الاغلب كل الطلبة لم يحاولوا الاطلاع على اي مقالة او تعليمات كتابة فصل الاستنتاجات ولم يأخذوا درسا متخصص بالكتابة ضمن مناهجهم الدراسي. فهم فقط يحاكون اسلوب الكتابة للطلبة السابقين الذين اكملوا دراساتهم بغض النظر اذا كانت الكتابة صحيحة او خطأ. تستنتج هذه الدراسة الى ان كل الطلبة على الاغلب ليس لديهم المعرفة او المهارة بعملية الكتابة العلمية وخصوصا في كتابة محتوى الاستنتاجات. لذلك توصي الدراسة بشدة الى اعادة تقييم منهج طلبة الدراسات العليا من اجل ان يشمل دروسا لتحسين مستوى الكتابة العلمية للاطارح والرسائل الجامعية.