Knowledge Construction Practices in Geographisal and Environmental Research

Dr. Ahmed H. I. Elfaig[1] & Dr. Mohamed Elnour Yassen Ahmed[2]

Abstract

This article focuses on Knowledge construction in Geographical and Environmental Sciences. The main purpose of the paper is to examine how knowledge is constructed in texts produced in these enquiry domains. The paper depends on randomly selected published and unpublished materials such as thesis, dissertations and articles that depended on qualitative knowledge elicited from domain expert and secondary sources supported by quantitative methods from the field. 40 samples were randomly selected including master's theses, Ph.D. theses and published articles. The result showed that in 79.3% of the selected academic materials the knowledge had been constructed in the form of knowledge base format in heuristic form and knowledge modeling paradigm. It also indicated that the knowledge had been made in rules format espoused rule of thumb including parameters, variables, numerical values, tables, diagram, correlation coefficient, significance level, and fuzzy logic and certainty factors. Results also showed that 20.7% of the knowledge had been constructed in declarative forms and 57% used certainty factor (P). The paper further showed that the constructed knowledge had been translated and transformed in form of structure rules and models which can be graphically illustrated. The study concluded that constructed knowledge had been widely verified and validated, with space for disputed.

Key Words: Construction, Knowledge, Academic Writing, Geography, Environment, Validity, Certainty

1. Introduction

Academic writing as a way of constructing or creating knowledge is a form of researching in itself (Badley, 2009). The reasons, for academic writing include an assessment of what has been written as an aid to critical thinking, understanding and memory (Hyland, 2013). The purpose of academic writing may also include academic literacy which is at the heart of Knowledge construction (Hyland, 2011). Many arguments, e.g., Hyland, 2004, viewed that knowledge is constructed within social communities, and within these domains writing instruction, creates knowledge and defines their academic allegiances. Generation of new knowledge means creation and innovation. The generated knowledge should be transformed into formal knowledge 'formal' in the sense that the knowledge is institutionally defined (Freebody, 2013).

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[1] Associate Professor at the Faculty of Geographical and Environmental Sciences, University of Khartoum. Corresponding author: elfaig10@gmail.com

[2] Associate Professor of Geography at the College of Arts, King Faisal University, KSA

Knowledge construction means generation, production and creation of new ideas. It includes processes of amalgamation, interpretation, analysis and evaluation of knowledge. This can be done through critical thinking to create and develop further new knowledge. Knowledge construction also involves accumulation of empirical evidences. Some types of knowledge construction pass through four phases. These are initiation, exploration, negotiation and co-construction (Onrubia and Engel, 2009).

The application of knowledge construction in academic writing is almost endless. Wherever, scientific research is needed to solve problems, a systematic and suitable knowledge construction and format is needed. This area includes different discipline (Geography, Environment, Geology, Economy, Agriculture…etc.).   As such the objectives of this article can be summarized as follows:

i. To examine knowledge construction practices from a geographical and environmental perspectives for the selected academic materials produced at the Faculty of Geographical and Environmental Sciences (FGES).

ii. To examine knowledge representation in a geographical and environmental sphere for the selected academic materials produced at the (FGES), University of Khartoum.

Based on these objectives, the study attempts to answer the following questions:

i. What is the nature of geographical and environmental knowledge produced in research at the Faculty of Geographical and Environmental Sciences (FGES)?

ii. How is the knowledge constructed and produced in geographical and environmental research at the Faculty of Geographical and Environmental Sciences (FGES)?

2. Materials and Methods

Data for this study was collected from many secondary sources, namely; unpublished thesis where the available data are sufficient to come out with required solutions of the research problem coupled with published materials. A total of forty (Ph.D., Master theses and articles) were randomly selected and were distributed as follows: twenty Ph.D. thesis, ten master theses and ten published articles in local and international Journals.

Justification for selection of these materials stems from the facts that, Master's thesis is the most sustained and complex piece of academic writing for master's students. A Ph.D. these can be seen as new contributions to human knowledge and understanding   (Swales. 2004). As for published articles, that may be cited to contribute to knowledge accumulation and generation as citation is central to provide justification for arguments (Hyland, 2004). However, there are rules that govern how to cite and what to cite, (Badenhorst, *et.al*. 2015). A fundamental element of disciplinary epistemology is the increment of disciplinary knowledge as scholar has an article published in the discipline's forums, such as journals and conferences; he/she is contributing to the discipline's knowledge construction (Li, 2006).

Knowledge acquisition processes involve collecting, eliciting, organizing, analyzing and interpreting the knowledge use in solving a particular problem (Setito and Dillon, 1994; back, 1994). The importance of knowledge acquisition emerges from the fact that it is crucial to the utility and acceptance of any thesis or article. This should include knowledge refinement, validation and verification (Hart 1986)

3. Results and Discussion

The study and analysis of the selected theses and articles (academic materials) reflects that there are many sources of knowledge construction and different ways of knowledge representation which can be summarized as follows:

i. The geographical and environmental research, materials and knowledge found in the selected articles are genuine. The research in this domain is considered as a main source of Knowledge, because it objective involves systematic procedures.

ii. Methods of knowledge elicitation: two main methods are well recognized in knowledge elicitation from the domain experts or from individuals. These were done through structured and unstructured interview. Therefore, the knowledge is extracted through the questionnaire-interviews conducted with the domain experts aiming at selecting and ranking important parameters that contribute to research problem as they are knowledgeable and have considerable expertise on the research problem.

iii. Methods of Analysis: For the analysis of data, descriptive and statistical methods and techniques are used for description of the information and for establishing relationship between different variables and parameters to evaluate the accuracy of the results obtained. Descriptive and non-parametric statistic methods were used for the analyses and results are presented in tabular formats. The articles widely used Chi-square test to determine the probability of the difference in the observed and expected values having occurred because of sampling variation. It was used to test the presence of a significant relation between the two variables

iv. Most of the studies conducted with domain experts such as traditional farmers and pastoralist. Those targeted groups have expertise and long experience. Experience by itself is a common mode of obtaining knowledge.

v. Some of the studies tackles research problem through traditional methods of dealing with a problem such as traditional adaptation with environmental change in both traditional agricultural sector as well as traditional grazing system. Tradition is considered another source of knowledge: human being inherited culture. Culture is a reflection of an adopted system of rules, norms, standard and values. The main transmitters of cultural knowledge are parents, peers and society. However, the main weakness of tradition as a source of knowledge is acceptance of social truths without necessarily testing them.

vi. Authority is another source of knowledge found in some selected materials: In form of experts in specialized area. E.g. Transmission of AIDS/HIV if stated by doctors rather than engineer. However, the main weakness of authority as a source of knowledge is authorized persons speaking outside his realm of knowledge and expertise.

The study shows that the following knowledge is presented in most of the studies:

i. Declarative knowledge which is used to describe the problem characteristics, problem concepts and to provide problem statement.

ii. Knowledge aims at getting individuals subjective response.

iii. Knowledge assists to build base for problem domain. The main sources of such knowledge are the domain experts and textual sources.

iv. Heuristic Knowledge is the knowledge used to make good judgment or strategic rule of thumb.

**3.1 Methods used in generating ideas and knowledge**

The results show that the focused and structured interviews are widely used aiming at collecting data and knowledge to identify and characterize the problem concept. They are also used to detail out the conceptual model and sub-modules of the problem. However, there is no single concept of geographical knowledge

(Archie, 2015, 23) as different types of geographical knowledge serve different type of research. More specifically, the result shows that 90% of theses and articles examined have conceptual model and sub-modules serving as starting points for the analysis. The sub-modules help in analyzing and reflecting the relationships between different factors and causes of the problems as shown in Figure 1. It reflects processes of identifying relationship among ideas, analysis and evaluation.

Figure 1: Conceptual Model as a Mean of Generating Knowledge
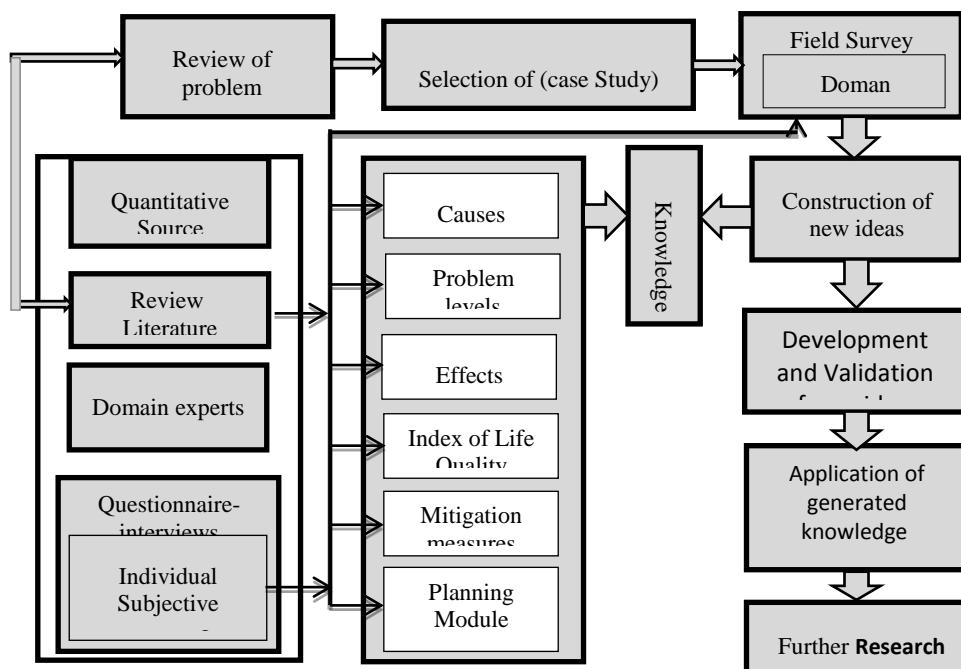
This figure reflects the conceptual models, module, and sub-modules as means of generating knowledge. It represents the starting point for the analysis and creation of new ideas and knowledge that has been elicited from domain experts, textual sources, and fieldwork.

3.2 Predictive Modeling (Means of creating new ideas and Knowledge)

Most of the selected theses and articles use predictive modeling as a process of analyzing data, information and knowledge to specify the outcome. The predictive modeling using input data about given situation to infer future consequences or outcomes based on existing knowledge it has (Ridingger et al., 2000). Some articles (25%) use a regression statistical models which were based on secondary data and information as

well as existing knowledge which are more consistent. The model has constraints and two main parameters: dynamic parameters and static parameters.

3.3 Knowledge Model

Developing the knowledge model, knowledge structure, presentation and organization are very important in knowledge construction in academic writing. It consists of tables, diagrams and structure text. Such a knowledge model can be graphically illustrated to reflect the component and integrated nature of different modules of problem domain as shown in tables 1 and 2 below.

Table 1: Forum of Knowledge Construction and Representation

Type	No. of selected materials	No. of Tables	No. of Graphs	No. of Diagrams	No. of models
Research articles	10	50	30	23	8
Master Thesis	10	45	35	43	12
Ph.D. Thesis	20	173	40	161	13

This table shows that the diagrams and tables were identified as the major structure of knowledge representation. It also shows that a small segment of the produced academic materials use models as a method of knowledge representation. Such models have dynamic variables, statistic variables and constrains.

Table 2: Knowledge Construction and Representation

Type	No. of selected materials	Type of impeded knowledge		Certainty factor (P)		Representation of knowledge construction	
		Declarative	Heuristic	Used	Not used	Declarative	Heuristic
Research articles	10	31%	69%	72%	28%	18%	82%
Master Thesis	10	18.2	81.8	36%	64%	19%	81%
Ph.D. Thesis	20	35%	65%	63%	37%	25%	75%

Table 2 shows that 57% of the produced academic materials uses certainty factor. It also illustrates that, about 79.3% and 20.7% of the knowledge was constructed in heuristic and declarative forms, respectively. This obviously reflects the type of knowledge impeded in such materials.

3.4 The phrase and words used

Some words and phrases are widely used in quantitative and qualitative forms of knowledge construction as shown in Table 3. Generally the phrases used to discuss qualitative data are less certain than those used to discuss quantitative data as evidenced by the words 'suggests', 'seems' and 'argues' compared to 'provides evidence', 'confirms' and 'verify' respectively.

Table 3: Words and phrases used in knowledge construction

Genre	Phrases widely used
Qualitative	most of the respondents
	This article has come up with…
	The study suggests as common style of writing.
	It seems that…..
	These ideas certainly applied to…
	This articles emphases on…..
	The study argues that …
Quantitative	This study provides evidence
	This article confirms that…,
	These findings verify that…..
	about 50 % of the respondents

3.5 Knowledge Validation

Knowledge validation is a quite complex task. When we applied different types of validations on knowledge found in the selected articles and thesis, the following points can be raised:

i. In terms of knowledge content, most of the thesis output compared with other results found in similar thesis. It also shows that the models used are similar to the models found in other theses.

ii. In terms of criterion of knowledge, the level of knowledge and knowledge structure found in most of the thesis is generally accepted.

iii. In terms of objective evaluation of the existing knowledge, the actual results of the selected articles are by and large   accepted.

4. Conclusion

The study of knowledge construction in academic writing in geographical and environmental aspects has come out with the following points:

i. The available literature on knowledge construction in geographical and environmental perspective is rich in this aspect. However, knowledge construction is dealt with in a wide perspective and the results were generalized which hinders and minimize its usability.

ii. Great variation in knowledge construction between articles using qualitative data and articles using quantitative data are found. Such variations are due to differences in nature of study and methods of correlations between different variables.

iii. The study shows that most of the articles use Gulford's rule of thumb to interpret the results   and outcome of the study that explained 40% of the variation in the data set.

iv. Result also reflects that almost 30% of the theses has a moderate substantial knowledge embedded in the text and has no systematic construction of knowledge.

v. The types of knowledge found in the articles are declarative and heuristic.

vi. Certainty factor (CF) is widely used in almost 75% of the reviewed articles.

vii. Ranking and weighing are used.

viii. Fuzzy logic expression like low, moderate, high as qualitative terms are widely used in the articles.

ix. *If ...then* formats used in rules building as a prominent feature in knowledge structure.

x. Use of biased words found in the selected articles will not help in generating new knowledge. Such words include (show, confirm, verify, prove, explain, validate). Instead, using neutral words is highly recommended and may help in generating knowledge such as (explore, compare, investigate, test, examines)

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