

# Transitivity analysis of practical instructions in selected Nigerian senior secondary schools biology textbooks

Olufunke Damilola Degboro and Festus Moses Onipede\*

Department of General Studies, Federal Polytechnic Ilaro, Ogun State, Nigeria

\*Corresponding author. Email: [onipedefestusmos@gmail.com](mailto:onipedefestusmos@gmail.com); Tel: +234 8166065300.

Copyright © 2022 Degboro and Onipede. This article remains permanently open access under the terms of the [Creative Commons Attribution License 4.0](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received 1st June 2022; Accepted 27th June 2022

**ABSTRACT:** This study is concerned with transitivity analysis of selected Nigerian senior high school biology textbooks. The aims of this research were to describe and to find out the dominant process types of transitivity occurrence, reason behind the choice of dominant process, and its effect in the biology practical instructions. This study was descriptive qualitative. The data were obtained from the selected two Nigerian biology textbooks *entitle Essential Biology for Senior Secondary Schools*, and *Modern Biology for Senior Secondary Schools* by M. C Michael, and Ramalingam respectively. The result of the research was four types of process that occurred in the textbooks. There was material process (90.83%), mental process (4.59%), relational process (3.67%), and existential process (0.92%). The dominant type of transitivity is material process. It means that biology practical instructions textbooks contained action and physically. Furthermore, the benefit that can be gained from analysing the transitivity in the text could stimulate the reading skills to comprehend the idea and information in a text that could be applied in spoken and written texts. Based on the finding of the transitivity analysis, it was recommended that, serving teachers be trained through workshops, seminars, conference s and in-service programmes.

**Keywords:** Biology textbooks, experiential meaning, practical instructions, transitivity.

## INTRODUCTION

Implementation of the practical instructions in teaching biology experiments need to consider biology textbook. A textbook contains several learning materials to support the learning and teaching process in science practical laboratory. Textbook contains the material about a specific subject of study that is arranged systematically and has been selected based on specific objectives, learning orientation and students' development (Muslich, 2016). Klemenčič and Čepič Vogrinčič (2014) see textbooks as core of learning materials or documents within the field of education both in printed and in electronic form. Biology textbook contains practical instructions which contain steps, explanation on how certain experiments can be carried out. The imperative nature of practical instructions presents the text in the form of reading activity. Reading is the activity engaged in by the students to deciphering the contents of the text using their reading skill to get the intended information. Reading is concerned with

comprehensive expression of vocabulary, language structure, culture and reading speed (Irwandi, 2017). Practical instructions require appropriate interpretation of the experiment guidelines or steps to get accurate results. Through reading, students are able to follow the instructions to gain the knowledge and information embedded in the text.

The purpose of communication is to pass across information. Here, meaning is essential for communication to take place. If students are unable to make meaning out of the given practical instructions, it therefore means that the experiment will not be effectively carried out. Systemic Functional Linguistics (hereafter, SFL) is a theory of language that is based on meaning potential. SFL comprises three main kinds of meaning - ideational, interpersonal and textual. The three types of meaning are called "metafunction". Ideational metafunction centres on human experience of the world, that is, human perception.

It consists of logical and experiential meaning. Logical meaning focuses on the relationship between ideas and the meaning between clause complex, and the experiential meaning is based on content or ideas (Emilia, 2014). In the words of Thompson (2014), experiential meaning is used to talk about the world. Logical meaning is seen as the language of clause as representation. By clause as representation, we mean the representation of the experience of both external and internal reality. Experiential meaning is realised by transitivity. Transitivity is known as verb in traditional grammar. It is a grammatical system that deals with various types of processes and relate to content or ideas expressed in the clause. Transitivity construes the world of experience into a manageable set of process types (Emilia, 2014) such as material, mental, relational, verbal, behavioural and existential. The first three being the major types of process and the last three being the minor types. According to Thompson (2000), transitivity is a system for describing the whole clause, rather than the verb and its object. Through the systems and networks of transitivity, users of a language are able to convey their experience of the external world of the senses and the internal world of the mind. Process of transitivity refers to the "goings-on" in reality, for instance, doing, happening and being. Halliday (2008) identifies six processes in the transitivity system which represents human experience in terms of: physical and physiological actions (Material and Behavioural), thinking and speaking actions (Mental and Verbal) and actions that signal the existence of something/someone and their identifying features (Existential and Relational).

A good number of researches have been carried out (Halliday, 1967, 1976; Hopper and Thompson, 1980; Langacker, 1987; Halliday, 2001, 2008) to extend the domain of the study of transitivity. From Halliday's perspective of transitivity system, the material process, a process of doing, usually describes concrete and tangible actions. The process expresses the notion that a participant, the Actor, "does" something—which may be done "to" some other participant, the Goal. The mental process is concerned with the process of sensing and it deals with states of mind or psychological events. It has two participants - the Senser (endowed with consciousness) and the Phenomenon (realised as a thing or as a fact). Relational process is described as a process of being, which establishes a relation between two separate identities. Relational process is of two types - the attributive relational process with the Carrier and the Attribute as the participants, and the identifying relational process with the Identified and the Identifier as the participants. Related to mental process is behavioural process which deals with human psychological and physiological behaviour. It has only one participant called Behaved. Being partly like material and mental processes, it's the least distinct of all the six process types, especially in the language of science. Verbal process is concerned with process of saying. It has three participants, namely

the Sayer, the Receiver and the Verbiage. The Sayer, the participant responsible for the verbal process, is typically but not necessarily conscious. The Receiver is the participant to whom the saying is directed. The Verbiage is characterised by nouns expressing verbal behaviour, such as question, story and report. The existential process deals with a participant that is being said to exist, the Existent. It is a process of existence. It is realised by the There-construction in English which has no representational function and there are no human participants in existential processes.

Wu (2004) analysed mental processes in the English emails used in academic discussion. The findings showed that a high frequency of mental processes mirrored the interactive style of the discourse. Babaii and Ansary (2005) examined academic book reviews from discipline-related professional journals, such as physics, sociology, and literature. Their findings showed that book reviewers in different disciplines favoured different devices in conveying their messages and in striking a balance between impersonality and interaction. Gong and Fang's (2005) analysis of process types in court debate showed that the ideational function in the court discourse is mainly realised through the process of transitivity. Again, most of experimental researches conducted on transitivity analysis revealed that the relationship between the transitivity structure and certain specific stylistic features of research articles. For instance, Martinez (2001) investigated impersonality in research articles of the transitivity structure in corpus of twenty-one (21) research articles in the fields of physical, biological and social sciences. The findings revealed that a tension between the need to present findings objectively and the desire to persuade readers of their validity in an appropriate style. The findings further revealed that the preference for impersonal constructions in research articles may result from the strategic choices of process types made by the writers.

Similarly, Pang and Chen (2007) applied genre analysis to examine the features of transitivity in different sections of research articles by analysing six research articles in psychology and material science. Their research findings revealed that different percentages of transitivity processes used in the four sections and the different objectivity degrees constrained the author's choice of language. The transitivity features and choices therefore add to the understanding of the functional role of transitivity in research articles in general, but rare in process types in medical research articles.

Moreover, a number of studies (Adams-Smith, 1983; Grant and Laird, 1997; Hemminki, 1982; Nwogu, 1997) showed the difficulties faced by writers of medical research articles in organising their thoughts or structure of their works. These researches showed that a better understanding and proper choice of process types in an English-medium medical research articles will help medical research articles for publications. Again, Wushishi et al (2016) examined the effect of Hausa language as a

medium of instruction on academic performance of secondary school biology students in Sokoto State, Nigeria. The study revealed that the use of Hausa language as a medium of instruction in biology enhances performance among students. In the same vein, Okechukwu et al. (2018) evaluated the content coverage and readability of biology textbooks in use in Nigeria secondary schools. The findings revealed that three out of the four evaluated biology textbooks covered the content stipulated by the curriculum but one of the biology textbooks is not readable. Racheal et al (2016) carried out the evaluation of recommended biology textbooks in use in Nigeria secondary schools, using the 8-point quantitative model for science textbooks evaluation developed by Emerole and Rammiki (2008). The study revealed that all the four biology textbooks evaluation employed study questions.

Application of SFL helps students see how meaning and form in the various choices in the grammatical system and know how language is construed in textbook. In view of the above explanation, the analysis of transitivity in the selected Nigerian senior secondary schools biology textbooks will facilitate the teacher in teaching grammar and meaning in the text meant for communicating practical instructions. It will also help biology textbooks authors to build grammar in text analysis which could be in spoken or written forms. Application of SFL to Biology practical textbooks will help both the authors (teachers) and students teaching and learning. For the teachers, it will increase their creativity in teaching and for the students; it will allow them to think critically of a phenomenon by analysing the relationship, meaning, content and purpose of the text.

To the best of our knowledge, no study has been reported focusing on the transitivity analysis of selected Nigerian senior secondary schools biology practical instructions textbooks. To fill this gap, we conducted this transitivity analysis to describe and to find out the dominant process types of transitivity occurrence, reason behind the choice of dominant process, and its effect on the biology practical instructions. The objectives of the study are to find out the authors' use of transitivity process, the most dominant of transitivity process, and the reason behind the preponderance of the choice of process in Nigeria biology practical textbooks.

## MATERIALS AND METHODS

This study makes use of qualitative study. It focuses on the realisation of transitivity systems in selected Nigerian senior secondary schools biology textbooks on the aspect of practical instructions. We take those texts from the selected biology practical instructions on test for photosynthesis. Thus, purposive sampling is adopted to select practical instructions passages. According to Arikunto (2006, p. 139), purposive sampling is the process

of selecting sample by taking the subject that is not on the level or area, but it is taken based on the specific purpose. It usually involves selecting a representative sample by the expert judgment. After gathering the data, we engaged in the following steps: Firstly, we read the practical instructions to get the highest type of process used. Secondly, we break down the selected texts into 109 clauses. Thirdly, we analysed and identified transitivity systems using table of instrument to put those clauses. There is a theory proposed by Halliday and Matthiessen (2004) to determine the transitivity systems realised in the selected biology textbooks. The fifth step allows us to calculate the occurrence of every process types along with its participants and circumstances in the selected practical instructions. The sixth step concerns with interpreting the findings to draw the realisation of transitivity systems in the selected texts. We finally tried to present the result of the findings descriptively. The following abbreviations: pr, cir, cog., Rel., stand for process, circumstance, cognition, and relational respectively.

## RESULTS

The data were taken from M. C Michael (2001) Essential Biology for Senior Secondary schools and Ramalingam (2013) Modern Biology for Senior Secondary schools. The passages containing practical instructions on test for photosynthesis and transpiration were selected for analysis. The data were analysed based on the process of transitivity. There are six processes in the transitivity analysis; those are material process, mental process, relational process, verbal process, behavioral process, and existential process. In the study, it was found and analysed 109 clauses. The distribution of transitivity analysis in the practical instructions can be seen in Table 1.

From the distribution (Table 1), it can be known that the material process occurred 99 times, mental process had 5 times, relational process was 4 times, behavioral and verbal processes got zero, and existential process was 1 time. Table 1 shows that material process is the most dominant process found in the selected textbooks. It had 99 clauses or 90.83%. Then, mental process and relational process are in the second and third position respectively. Mental process got 5 clauses or 4.59% and relational process got 4 clauses or 3.67%. The fourth is existential process. It has only 1 clause or 0.92%. The last processes (behavioural and verbal) have no clause.

## DISCUSSION

This part is used to discuss the interpretation of the transitivity process obtained in the data. Based on the data calculation, there are four (4) transitivity processes found, those are material process, mental process, relational

**Table 1.** The distribution of transitivity analysis and the appearances of processes in the textbooks

Processes	Frequency of appearances	Percentages
Material	99	90.83%
Mental	5	4.59%
Relational	4	3.67%
Behavioural	0	0
Verbal	0	0
Existential	1	0.92%
Total	109	100%

process, and existential process. The explanation about the four transitivity processes can be seen below: The first is material process, there were 99 material transitivity found from all the data analysed. Material process must have an action (process), an actor (participant) and goal, it is classified into three parts, and they are actor, process, and goal. In the study, it was found that in each sentence, it almost used actor and goal in active clause, and it has just one passive clause. It is obtained in the two selected biology textbooks practical instructions. The following shows some clauses of descriptive text used material process:

Dip	the leaf	into a test tube
Pr: Material	Goal	Cir.: Location

The leaf	is tested	for starch
Pr: Material	Goal	Cir.: Manner

Place	the water plant	at the bottom of the beaker
Pr: Material	Goal	Cir.: Location

The authors used material process in their practical instructions to explain the actor does or acts. It is the process of actor doing something, and something is done by an actor, called goal. In the study, the students can understand the function of actor and goal in their clauses, for instance, dip the leaf into a test tube, the authors, through command, give the function of an actor, and make the actor to have a goal, the leaf, and of course dip as a verb is used to express material process.

The second process is mental process, it relates to thought, feeling, and perception. In addition, perceiving in the mental process are seeing and hearing. The happening is sensed like felt, thought, heard, and seen. Mental process consists of sender, process (cognition, affection, and perception), and phenomenon. In mental process, kinds of clauses usually used by the authors are mental cognition and perception. The total of clauses identified as the mental process in authors' descriptive instructions is 5. The following shows some clauses of descriptive text used mental process:

This	shows	That.
Sender	Pr: Mental [cog.]	Phenomenon

The whole experiment	now	exposed	to sunlight for several hours
Sender	Cir.: Time	Pr: Mental [cog.]	Cir.: Location

The authors used mental process in their descriptive practical instructions to describe what someone (sender) thought, feel, and perceive about a thing / a person. Someone who thinks, feels, and perceives, called sender. What a sender thinks, feels, and perceives namely mental process. The thing is thought, felt, and perceived, it can be said as phenomenon. In the study, the authors can make students understand how to use the mental process in clauses, for example, *this* shows that sunlight is necessary for photosynthesis (the result of the experiment) is a sender, show is as mental affection process (feeling), and that is considered as a phenomenon.

The third is relational process; we found 4 clauses from the data. In the relational process, it is divided into three parts, those are carrier, attributive (intensive, possessive, and circumstantial), and attribute. The following shows some clauses of descriptive text used relational process:

Sunlight	is	necessary	for photosynthesis
Carrier	Pr.: Rel.	Attributive	Cir.: Cause [Purpose]

It	is	air-tight
Carrier	Pr.: Rel.	Attributive

The authors used relational process in their descriptive practical instructions to explain and identify (identifying) what they described. Also the relational process uses to give a quality to something (attributing). For instance, sunlight is necessary for photosynthesis. The authors make students try to identify and attribute someone described, sunlight (carrier), is *is* attributed as attribute, and necessary is an attribute.

The last process is existential process; it is identified as intransitivity which explaining the existence of something. In the existential, the author used it 1 time. It can be seen below: In the existential process, authors used one time. It can be seen below

There	is	sunlight
	Pr.: Existential	Existent

In the study, the authors used the existential process to explain the existence of something. To explain existence, it uses there and to be (past/present/future). The only occurrence of there is used in singular present tense form. For instance, there is sunlight, there is shows existential process, and sunlight is identified as existent.

From discussion of the study above, the most dominant transitivity process is material process. The authors used it to write the descriptive practical instructions text; it has a function to describe an activity or a doing done by doer.

The second dominant transitivity process is mental process. It is a transitivity involving feeling, thinking, and perception, in which these three kinds are used to describe an object in the descriptive practical instructions. The third dominant transitivity process is relational process. The authors used it to write the biology practical instructions in accordance with its function, to describe, attribute, and identify. The last process found in the data is existential process. It tells the existence of something. It is clear from our analysis that four process types are needed in writing biology practical instructions. The mental process used in the textbooks are to show the way things look, smell, taste, or sound; or evoke mood, such as happiness, loneliness, or fear (Wishon and Burks, 1980). Biology practical instructions are descriptive text that identifies, and describe the object. This corroborates Knapp and Watkins (2005) submission that descriptive text consists of identification and description is a process on how to describe the object. Absence of verbal process in the data shows that biology practical instructions only deal with direct instructions on how students can go about their experiments.

## Conclusion

In the study, it was found 109 clauses in the four transitivity processes. Material process got 99 times or 90.83%, mental process obtained 5 times or 4.59%, relational process was 4 times or 3.67%, and existential process was 1 time or 0.92%. From the result of analysing the transitivity process of the selected textbooks, we can conclude that, authors used four transitivity processes in writing descriptive practical instructions text. The most dominant is material process and the lowest is existential process. Based on the finding of the transitivity analysis, it was recommended that, serving teachers/authors be trained through workshops, seminars, conferences and in-service programmes. Furthermore, the analysis of transitivity allows the teachers/authors/students to comprehend the transitivity in the text to facilitate the teaching and learning of biology practical through functional grammar to make meaning in the text which aims to communicate. It could also help the teachers to build grammar in the text analysis which is useful in spoken and written text.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## REFERENCES

Adams-Smith, D. A. (1983). Style in medical journals. *British Medical Journal (Clinical Research Edition)* 287(6399), 1122-1124.

- Arikunto, S. (2006). Produser Penelitian. *Suatu Pendekatan Praktik*, Jakarta: Rineka Cipta.
- Babaii, E., & Ansary, H. (2005). On the effect of disciplinary variation on transitivity: The case of academic book reviews. *Asian EFL journal*, 7(3), 113-126.
- Emilia, E. (2014). *Introducing functional grammar*. Bandung: Pustaka Jaya.
- Emereole, H. U., & Rammiki, R. (2004). Content evaluation of physics textbooks used in botswana secondary schools. *Mosenodi (Journal of Bostswana Education Research Association)*, 12(1), 69-81.
- Gong, J., & Fang, Y. (2005). An ideational functional analysis of argumentative discourse in English courts. *Foreign Languages Research*, 3, 11-16.
- Grant, J., & Laird, A. (1997). Writing for medical journals. *Current Obstetrics & Gynaecology*, 3(7), 149-155.
- Halliday, M. A. K. (1967). Notes on transitivity and theme in English Part I. *Journal of Linguistics*, 3(1), 37-81.
- Halliday, M. A. K. (1976). Types of process. In: Kress, G. R. (ed.). *Halliday: System and function in language* (pp. 159-173). London: Oxford University Press.
- Halliday, M. A. K. (2001). *Language as social semiotic: The social interpretation of language and meaning*. Beijing: Foreign Language Teaching and Research Press.
- Halliday, M. A. K. (2008). *An introduction to functional grammar* (3rd Edition). London: Edward Arnold/ Beijing: Foreign Language Teaching and Research Press.
- Halliday, M. A. K., & Matthiessen, C. N. I. M. (2004). *An introduction to functional grammar*. London: Hodder Arnold.
- Hemminki, E. (1982). Quality of clinical trials - A concern of three decades. *Methods of Information in Medicine*, 21(02), 81-85.
- Hopper, P. J., & Thompson, S. A. (1980). Transitivity in grammar and discourse. *Language*, 56(2), 251-299.
- Irwandi, D. I. (2017). Integrating intercultural communication competence in English literature teaching: The application of reading novel. *Inovasi Pendidikan*, 2(18), 69-77.
- Klemenčič, E., & Čepič Vogrinčič, M. (2014). Analysis of texts in the field of education: A regulation on textbook approval and a history textbook. *SAGE Open*, 4(3), 2158244014552430.
- Knapp, P., & Watkins, M. (2005). *Genre, text, grammar*. Sydney: University of New South Wales Press Ltd.
- Langacker, R. W. (1987). *Foundations of cognitive grammar*, 1. Stanford: Stanford University Press.
- Martinez, I. (2001). Impersonality in the research article as revealed by analysis of the transitivity structure. *English for Specific Purposes*, 20(3), 227-247.
- Micheal, M. C. (2001). *Essential Biology*. Lagos: Tonad Publishers Limited.
- Muslich, M. (2016). Dasar-dasar pemahaman, penulisan, dan pemakaian buku teks. Yogyakarta: Ar-Ruzz Media.
- Nwogu, K. N. (1997). The medical research paper: Structure and functions. *English for Specific Purposes*, 16(2), 119-138.
- Okechukwu, S., Ogbu, R., & Nnachi, N. O., & Ugama, J. O. (2018). Content coverage and readability of biology textbooks in use in Nigeria secondary schools. *Middle-East Journal of Scientific Research*, 26(4), 432-437.
- Pang, J., & Chen, M. (2007). Transitivity in research articles and the realization of communicative aims: a genre analysis perspective. *Journal of Foreign Languages*, 5, 16-22.
- Racheal, E. B., Okechukwu, S., Abonyi, G. O., & Chinyere, O. (2016). Evaluation of recommended biology textbooks in use in Nigeria secondary schools. *Journal of the Science Teachers Association of Nigeria*, 51(1), 81-94.
- Ramalingam, S. T. (2013). *Modern Biology* (6th edition). Onitsha:

- Africana First Publishers PLC.
- Thompson, G. (2000). *Introducing functional grammar*. London: Arnold/Beijing: Foreign Language Teaching and Research Press.
- Wishon, G. E., & Burks, J. M. (1980). *Let's write English*. New York: American Book Company.
- Wu, J. S. (2004). A multi-dimensional stylistic analysis of "academic E-mails". *Foreign Language and Their Teaching*, 1(2), 53-57.
- Wushishi, D. I., Ashafa, N. A., & Sadiq, H. O. (2016). Effects of Hausa language of instruction on secondary schools biology students academic performance in Sokoto State, Nigeria. *International Journal of Scientific Research in Science, Engineering and Technology*, 2(1), 551-558.