P-ISSN: 2339-2940
e-ISSN: 2614-8633

Process Types in Mechanical Engineering Texts: Transitivity Analysis

Mulyati Khorina

Department of English, Politeknik Negeri Bandung
Jl. Gegerkalong Hilir, Ds. Ciwaruga, Bandung 40012, Indonesia
Email: mulyati.khorina@polban.ac.id

ARTICLE INFO

Article history:
Received:01/10/2020
Revised: 15/11/2020
Accepted:26/11/2020

Keywords:
Mechanical engineering texts
Transitivity system
Material process
Relational process
Existential process

ABSTRACT

This paper reports the study of Mechanical Engineering texts which is concerned with Transitivity system. The study aims to investigate the process types that frequently occur in this kind of texts and find out the process type that dominated the texts. Hence, to analyze the qualitative data obtained from an introductory textbook of Mechanical Engineering, a Systemic Functional Linguistics framework was applied. The results show that only three types of process were identified: Material, Relational, and Existential. Among these process types, the Relational process appears to be dominant. These findings may implicate teaching ESP, primarily teaching English for Mechanical Engineering students.

I. Introduction

This paper reports the study of Mechanical Engineering texts viewed from Transitivity perspective. Transitivity analysis has been employed to study language from various views. The studies focused on textbooks [1]–[3], literary texts [4]–[6], speech [7]–[10], and translation [11], [12]. Hoang [2], who employed Transitivity analysis in exploring Vietnamese Biology textbooks, found out that the textbooks possess a very high frequency of material and relational processes. However, the researcher identified virtually no behavioural process, a low percentage of mental, verbal and existential processes. He also identified a relatively small number of circumstances and a high percentage of participants/Subjects. Whereas Bondar et al. [3] employed Transitivity analysis in studying English textbook for Vocational Highschool students, all types of Processes occur in the textbook in which material process became the dominant process. It is implied that Transitivity study focusing on Mechanical Engineering texts have not been conducted yet. Hence, this paper is investigating Transitivity study in Mechanical Engineering texts.

Transitivity system

The transitivity system belongs to ideational metafunctions. The system discriminates language as representing doing, behaving, sensing, being, saying or existing. This representation suggests six types of process which is evolving through time realized by the verb. The process is called Material, Mental, Relational, Verbal, Behavioural, and Existential [13]. In addition to the process, the other two elements of the Transitivity system are participants involved in the process commonly realized by nominal group and Circumstance associated with the process. The six process types and their participant are listed in Table 1, which is adopted from Martin, Matthiessen, and Painter [14].

Table 1. Process types and nuclear participants

Process type	Nuclear participants	Examples (participants in bold)
Material	Actor, Goal	***She*** *made* ***the coffee***
Mental	Senser, Phenomenon	***She*** *saw* ***the car***
Relational: attributive identifying	Carrier, Attribute Token, Value	***Maggie*** *was* ***strong*** ***Maggie*** *was* ***our leader***
Behavioural	Behaver	***She*** *laughed*
Verbal	Sayer	***She*** *replied*
Existential	Existent	*There was* ***a beautiful princess***

The material process occurring in material clauses are clauses of doing and happening. The participants involved in the clauses are Actor and Goal. Actor refers to what is traditionally labelled as the subject, while Goal is called an object in the traditional way. Several lexical verbs which realize this kind of process are developed, form, grow, produce, create, make, and prepare [13]. The mental process is the second type of process in this system which appears in mental clauses which deal with our experience of the world of our consciousness. This kind of clause concerned with a 'mental' clause interpreted a quantum of change in the flow of events in our consciousness. Some lexical verbs realizing the mental process are see, think, want, like, please, and encourage [13]. The third kind of process is the relational process, as the term suggests, relates one entity with another entity in the clause—the relational clause functions as characterizing and identifying. Thus, two sub-types of the relational process have different two sets of participants: Carrier-Attribute and Token-Value. Unlike the three kinds of previous processes, the other three types of processes Behavioural, Verbal, and Existential, only own one participant in their clause, as seen in Table 1.

Referring that the transitivity system works on various types of processes, this paper addresses whether all process types occur in Mechanical Engineering texts. It is essential concerning that grammar is the resource for making meaning strongly influenced by the context, especially the context of the situation through register elements--field, tenor, and mode—in which the texts occur. Thus, the grammar occurring in Mechanical Engineering texts will be different from other types of texts due to different register.

Exploring Transitivity in Mechanical Engineering texts will be benefitted not only theoretically but also practically. Theoretically, the findings will enrich linguistic theories, especially Systemic Functional Linguistics. Practically, the study results may implicate for English Language Teaching (ELT), especially English for Specific Purposes (ESP). As the term suggests, ESP is defined as the teaching and learning of English as a second or foreign language where the goal of the learners is to use English in a particular domain [15]. Hence, it is different from General English (GE) since it possesses two unique characteristics: absolute and variable. According to Dudley-Evans and St. John in Basturkmen [16], one fundamental feature of ESP is that ESP is centred on the language (grammar, lexis, register), skills, discourse and genres appropriate to these activities. Whereas one variable feature is that ESP is likely to be designed for adult learners, either at a tertiary level institution or in a professional work situation, and is generally designed for intermediate or advanced students.

Consequently, teaching English for Mechanical Engineering students will differ from teaching English for Accounting ones due to different disciplines. The differences will become a challenge either for the teachers or learners. This study, which employed Systemic Functional Linguistics, may help the teachers model the grammar of Mechanical Engineering texts, referring to grammar is the resource for making meaning. Modelling the grammar will enable the teachers to help their students in improving the students' grammatical weaknesses.

From what has been accounted above, this study has raised two issues.

1. What types of process appear in Mechanical Engineering texts?

P-ISSN: 2339-2940
e-ISSN: 2614-8633

2. What process type dominates Mechanical Engineering texts?

II. Method

This study employed a qualitative method with descriptive analysis. The data taken from "An Introduction to Mechanical Engineering [17] were analyzed by applying the Systemic Functional Linguistics framework. The stages of the study were presented below.

First, all clauses containing Process types on the Transitivity system were collected. Then, the clauses were classified according to the Process types. After that, the classified clauses were grouped into sub-process types. Next, the lexical verbs realizing each of the sub-process were identified. Then, the clauses were analyzed. The last conclusion was drawn, referring to the analysis. The steps of the study can be seen clearly in figure 1.

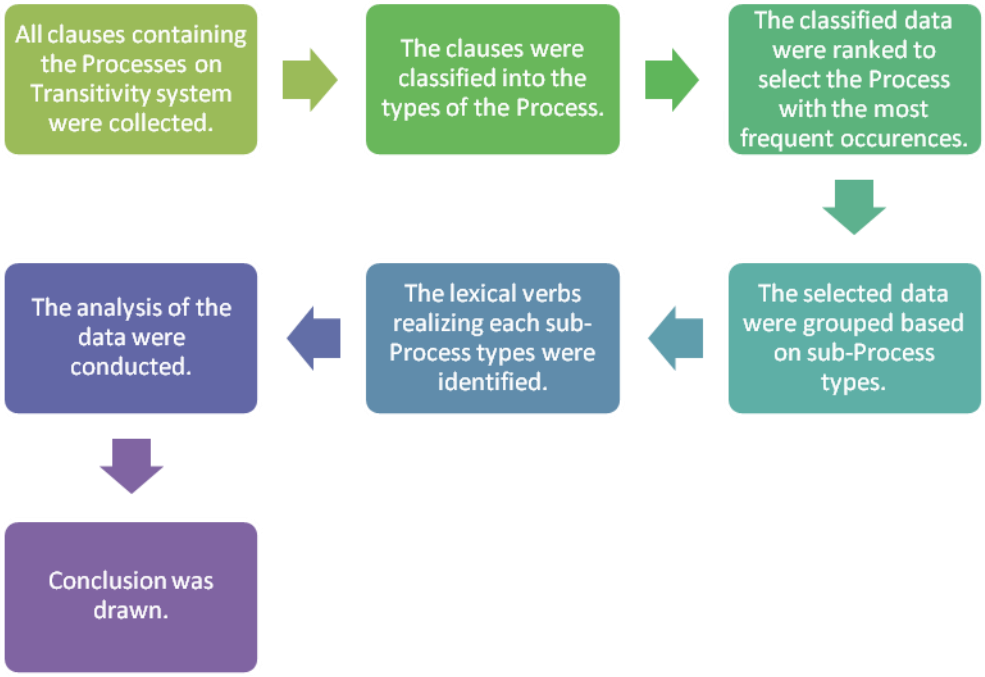

Figure 1. The process of data analysis

III. Results and Discussion

The results demonstrate that only three process types: material, relational and existential, as shown in Figure 2., which is different from what found by Hoang [2], who identified five process types in the Biology textbook and Bondar et al. [3] who stated that all process types were found in an English textbook for Vocational Highschool. The three process types found in the data are material process (37%), relational process (62%), and existential process (1%), which implies that relational process has the most frequent occurrences becoming one of the characteristics of scientific texts as stated by Martin [18].

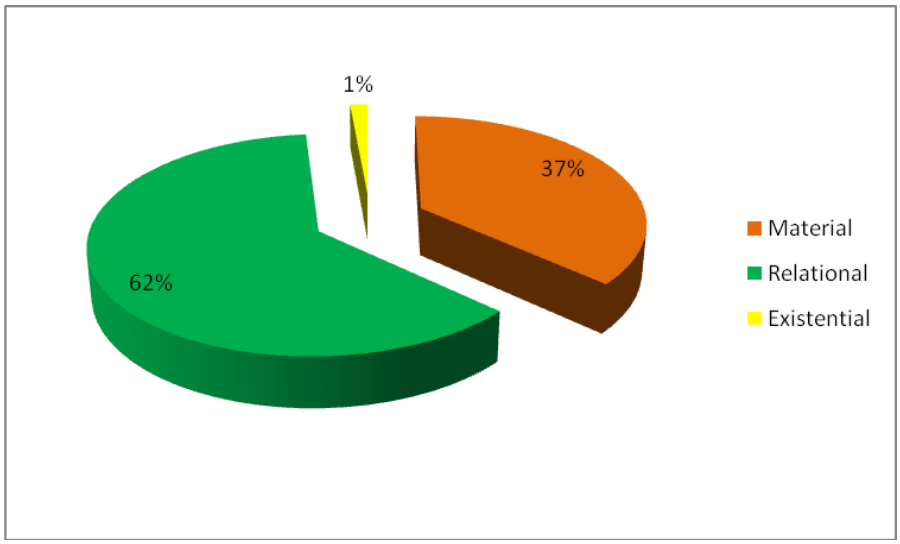

Figure 3. The Processes occurring in Mechanical Engineering texts

Moreover, the results also showed that both relational processes types were also identified: attributive and identifying, in which attributive relational process appears to be more highly in number than in identifying one as illustrated in Figure 3. However, the lexical verbs realizing the identifying relational process is slightly greater than those which realize the attributive relational one, as seen in Figure 4.

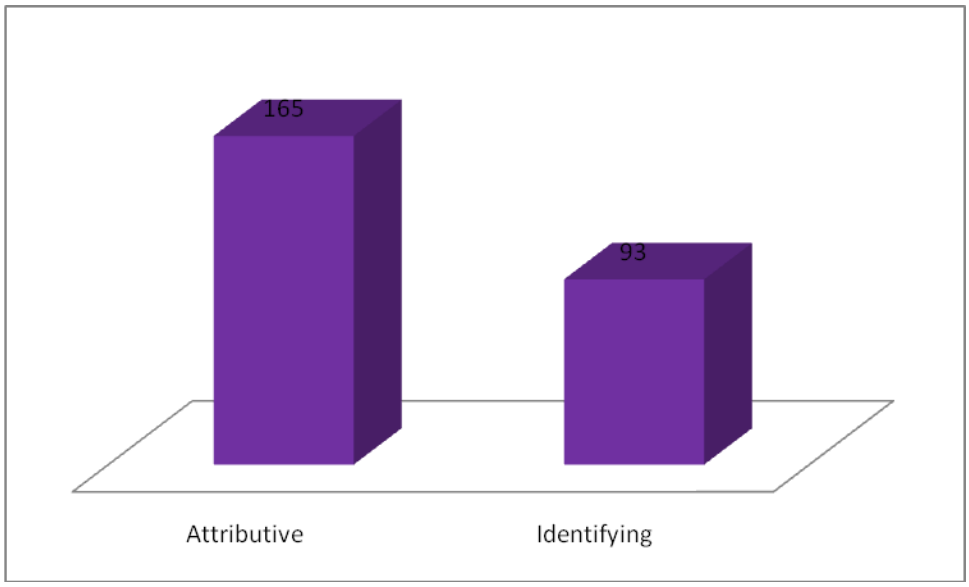

Figure 3. Relational Process types in Mechanical Engineering texts

Figure 4. shows that several lexical verbs realize the attributive relational process. They are *be* which has the highest use, followed by *use*, *have*, *make* and *support*. Whereas identifying relational process is realized by more choices of lexical verbs: *be*, which is not used as frequently as the attributive relational process uses it, *call*, *comprise*, *contain*, *function*, and *include* which the highest frequency used. The lexical verb be is the only one that may realize attributive or identifying relational process.

P-ISSN: 2339-2940
e-ISSN: 2614-8633

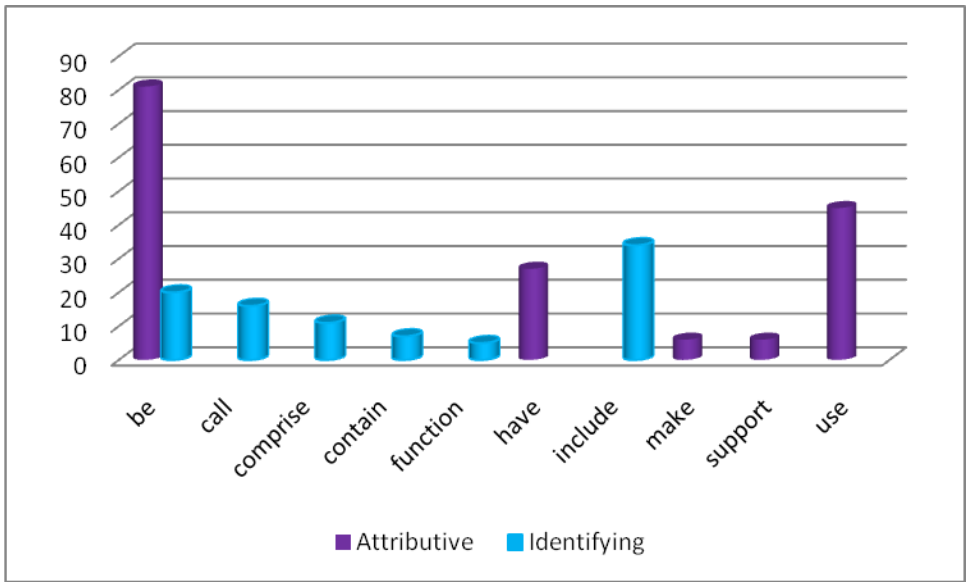

Figure 4. The Lexical Verbs realizing Relational process in Mechanical Engineering texts

Discussion

Referring to the study questions stated above, the discussion of the findings will be concerned with the relational process as the most dominant process found in the data. The relational process is divided into the sub-relational process: attributive and identifying relational ones. Some clauses containing attributive relational process and identifying one are taken from the data as the sample to be discussed.

Attributive relational process

As indicated in Figure 3., the attributive process appears to be more generous than the identifying process. In the attributive mode, an entity possesses some class ascribed or attributed to it. This class is labelled the Attribute. The entity is possessed by another entity called Carrier. Hence, this type of clause is a resource for characterizing entities serving as Carrier, and it is a central grammatical strategy for assessing by assigning an evaluative Attribute to the Carrier [19]. The attributive process is realized by the verbal group containing various lexical verbs: *be, have, make, support,* and *use.* These lexical verbs belong to the verb of equative class relating Carrier and Attribute as both participants in the relational process clauses. Carrier is commonly realized by a nominal group which may consist of Head only *patents* and *Metals* or Head and Modifier *The elastic modulus*, *A forged component, A mechanical or hydraulic press, A two-stroke engine*, and *The shaft.* However, Attribute is not only structured by a nominal group but also by a prepositional phrase.

The Attribute structured by a nominal group tend to have attributive process realized by *be* and *have* as in *The elastic modulus* ***is*** *a physical material property*, *A forged component* ***is*** *strong and hard, Patents* ***are*** *a key aspect of the business side of engineering, Metals generally* ***have*** *large values of k,* and *A two-stroke engine* ***has*** *a passageway.* When the Attribute is structured by a prepositional phrase, such as *to force heated metal, from a 10 mm diameter rod,* and *by ball bearings on each side of the belt,* in the clauses *A mechanical or hydraulic press is used to force heated metal, The U- bolt is made from a 10 mm diameter rod,* and *The shaft by ball bearings on each side of the belt,* the process tend to be realized by a verbal group in passive form. Table 2. shows it clearly.

Table 2. Attributive Relational Process

Carrier	Process	Attribute
The elastic modulus	*is*	*a physical material property*

A forged component	*is*	*strong and hard*
Patents	*are*	*a key aspect of the business side of engineering*
A mechanical or hydraulic press	*is used*	*to force heated metal*
Metals	*generally have*	*large values of k*
A two-stroke engine	*has*	*a passageway*
The U- bolt	*is made*	*from a 10 mm diameter rod*
The shaft	*is supported*	*by ball bearings on each side of the belt*
Nominal Group	**Verbal Group**	**Nominal Group**

Identifying the relational process

The data shows that the number of identifying relational process is not as many as the attributive relational process. The process tends to be realized by more various lexical verbs *be, include, comprise, contain,* and *function.* In the identifying mode, something has an identity assigned to it [13]. The Value is the entity that serves to identify another entity represented by Token. The Value tends to be realized solely by the nominal group. Table 3.

Table 3. Identifying Relational Process

Token	Process	Value
Spur gears	*are*	*the simplest type of engineering-grade gear*
Copper alloys	*include*	*brasses and bronzes.*
The equilibrium equations for a rigid body	*comprise*	*a system of three linear equations*
The utility patent generally	*contains*	*three main components*
The engine also	*contains*	*a means for fuel and fresh air*
The reactor	*functions*	*as the heat source*
Nominal Group	**Verbal Group**	**Nominal Group**

IV. Conclusion

In conclusion, only three types of process on the transitivity system occur in Mechanical Engineering texts. They are Material, Relational and Existential. Among the three types, the Relational process appears to be dominant almost twice as many as Material one. Relational process having two sub-processes: Attributive and Identifying, could be found in the data. However, the Attributive process is more significant in the number of identifying one.

On the other hand, the Identifying process is realized by more various lexical verbs than the Attributive one. Also, Attribution may be realized either by a nominal group or by a prepositional phrase, but Value is realized only by a nominal group. These findings may help ESP practitioners, especially those who teach Mechanical Engineering students, to focus their grammar teaching on those aspects.

ACKNOWLEDGEMENT

This research were funded by SIPPM Politeknik Negeri Bandung under contract number: Nomor: 8/249.'t 3/PL l.R7/PG.00.03/2020.

References

[1] E. Emilia, N. Y. Moecharam, and I. L. Syifa, “Gender in EFL classroom:

P-ISSN: 2339-2940
e-ISSN: 2614-8633

Transitivity analysis in English textbook for Indonesian students," *Indones. J. Appl. Linguist.*, 2017, doi: 10.17509/ijal.v7i1.6877.

[2] V. V Hoang, "The Language of Vietnamese School Science Textbooks: A Transitivity Analysis of Seven Lessons (Texts) of Biology 8," *Linguist. Hum. Sci.*, 2018, [Online]. Available: https://journals.equinoxpub.com/LHS/article/viewArticle/31751.

[3] G. K. Bondar, I. W. D. Tangkas, and E. Setia, "Transitivity Systems Analysis of English for Vocational High School (SMK) of Sosorgadong Textbook for Grade X and Its Relevance to English Language Teaching," *3rd Annu. Int. …*, 2018.

[4] R. Ezzina, "Transitivity analysis of «The Crying lot of 49» by Thomas Pynchon," *International Journal of Humanities and Cultural …*. 2016.

[5] T. H. Nguyen, *Transitivity analysis of heroic mother by Hoa Pham*. ro.uow.edu.au, 2012.

[6] J. D. Salayo and A. Lontoc-Macam, "Exploring character delineation: A transitivity analysis of O. Henry's 'A Retrieved Reformation,'" *Asian Journal of English Language …*. researchgate.net, 2019, [Online]. Available: https://www.researchgate.net/profile/Juland_Salayo2/publication/337647587_Exploring_character_delineation_A_transitivity_analysis_of_O_Henry's_A_Retrieved_Reformation/links/5de29e52a6fdcc2837faa07b/Exploring-character-delineation-A-transitivity-analysis-o.

[7] Z. Yujie and L. Fengjie, "Transitivity analysis of American President Donald Trump's inaugural address," *International Journal of Literature and …*. Science Publishing Group, 2018.

[8] Y. Zhang, "Transitivity analysis of Hillary Clinton's and Donald Trump's first television debate," *Int. J. Appl. Linguist. …*, 2017, [Online]. Available: http://www.journals.aiac.org.au/index.php/IJALEL/article/view/3760.

[9] M. Zhao and Y. Zhang, "A transitivity analysis of American President Donald J. Trump's inaugural address," *International Journal of Liberal Arts and Social Science*. ijlass.org, 2017, [Online]. Available: https://www.ijlass.org/data/frontImages/gallery/Vol._5_No._5/5._31-43.pdf.

[10] Z. Yuqiong and L. Fengjie, "Transitivity Analysis of David Cameron's Speech in Retaining Scotland," *International …*. article.sciencepublishinggroup.org, 2018, [Online]. Available: http://article.sciencepublishinggroup.org/pdf/10.11648.j.ijll.20180603.13.pdf.

[11] C. Jiang, "Quality assessment for the translation of museum texts: Application of a systemic functional model," *Perspect. Stud. Transl.*, 2010.

[12] R. N. Rosa, T. S. Sinar, Z. Ibrahim-Bell, and ..., "Metafunctional shifts in the translation of student and professional translators," *International Journal of …*. academia.edu, 2017.

[13] M. A. K. Halliday and C. Matthiessen, *Halliday's introduction to functional grammar*. books.google.com, 2013.

[14] J. R. MARTIN and C. MATTHIESSEN, "MIM; PAINTER, C," *Working with functional grammar. London: Arnold*. 1997.

[15] B. Paltridge and S. Starfield, *The Handbook of English for Specific Purposes*. 2012.

[16] H. Basturkmen, *Developing courses in English for specific purposes*. 2010.
[17] J. Wickert and K. Lewis, *An introduction to mechanical Enginnering*. 2012.
[18] J. R. Martin, *English Text: System and Structure*. 1992.
[19] M. Halliday, C. Matthiessen, and C. Matthiessen, *An introduction to functional grammar*. books.google.com, 2014.