RESEARCH ARTICLE

Technical Structures in Technical English

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ABSTRACT

At tertiary (Engineering Undergraduate) level of education, imparting of language - either as vocabulary or grammar - is often not considered vital on the assumption that the learners can derive the meaning of the word and the sentence from the context. Though the terminology and grammatical structures help in deducing the meaning, they equally account for the complexity in comprehension under the influence of the register. Hence, facilitating the learners to identify the nuances of grammatical structures used in the technical texts would not only aid in thorough comprehension, but also helps the learners to employ the same in their genre writing. Further, written communication of the fields requires great precision and clarity which demands the use of higher order thinking skills such as – organizing, synthesizing, analyzing, etc., in addition to coherence and cohesion which are needed in any composition. They can be achieved by employing accurate grammatical structures. The present study aims at exploring the use of grammatical structures such as tenses, modals, clauses, etc., in the technical texts.

Keywords: Tertiary level education, Grammatical structures, Genre writing, English as Second Language (ESL), Higher order thinking skills and Register.

1. INTRODUCTION

Communication in technical fields is carried out using various forms such as technical presentations, proposals, reports, field notes, journal articles, etc. Whether the mode chosen is written or spoken, communicating the message precisely according to the situation is a challenging task in the technical fields, as objectivity gains significance over subjectivity. In order to attain objectivity, it is important to employ language consciously and carefully, which can be achieved by employing appropriate technical structures, which are a part of the technical texts and slightly differ from the general usage in English. Though learners are exposed to the grammatical forms in the general English courses up to school level, certain emphasis is required in consolidating the grammatical forms as they would appear in the technical subjects, and there are certain differences in their usage. Peter Strevens opines that the difficulty in understanding the technical subjects is due to the intricately arranged patterns of the sentences. Thus, as the tertiary level content is heavy, and professional course content requires precision in expression, a thorough understanding of the grammatical structures encountered in the technical texts would contribute a lot to successful interaction both orally and in writing.

The basic pattern of sentence in English has “Subject (S) + Verb (V) + Object (O).” However, according to the need and importance, the subject and object could be reversed to denote the degree of importance given either to the doer or receiver of the action, which is generally observed in the register of
the technical texts. Herbert opines that the grammatical construction pertaining to syntax of the Technical writing is an important feature in which the learners need to be thorough; the use of “verbs, adjectives and adverbs which are not specifically scientific but which belong to the phraseology of science” might prove difficult. In English as Second Language (ESL) situation, the structures used in the technical subjects acquire significance as they are essential to the expression of technical facts and ideas. Though technical structures do not differ largely from general English, some of the grammatical forms which require emphasis during the tertiary level of learning are as follows:

1. Verb forms denoting different functions;
2. Active/Passive usage;
3. Clauses such as Relative (Active/Passive), Conditionals; and,
4. Linkers.

All these grammatical forms in one way or the other contribute to the synthesis of ideas, help in organizing technical facts, without which there is a scope for redundancy of expression, and incoherence [1-7].

2. VERB AND ITS FORMS

The forms such as Simple Present, Present Perfect, Passive form of the verb, Modals, Imperative verb forms which are used extensively in the writings of the technical fields are illustrated here.

Simple Present tense (used in general English to denote routine habits, repeated actions and universal truths) is used in the description of processes and products in science and technology; it is an important phenomenon as exemplified below:

- Metals expand when heated, and contract when cooled.
- Steels for permanent magnets contain about 30% cobalt.
- When the fuel in the tank reaches the required level, the inlet valve closes automatically.

Present Perfect tense in technical English has its distinct use in the passive form to denote the routine processes and repeated actions, which is otherwise denoted by Simple Present tense. The use of words like already, not yet, since, for, just, recently and lately are employed to convey the tense (time) aspect.

- Work has been started on the new system of motorways.
- Work on the motorway has not been started yet.
- Work on the motorway has recently been held up owing to bad weather.

Passive form of the verb contributes to more objectivity which is essentially required in technical communication. This structure can be used either with the retention of agent or omission of agent, which is determined by the significance given to the agent. The example provided denotes the use of Passive form of the verb (present, past, future) with the agent (noun) retained:

- Loss of efficiency is/was/will be powered by a small electric motor.
- Unequal contractions are/were/will be produced by rapid cooling of the metal.

Active form of the verb is employed when the agent is significant. However, when the active form should be employed, using the impersonal active statement by the introductory “it” or “there,” it can render further precision. The following example depicts the differences between the use of Active form, Impersonal Active form and the Passive form, which needs emphasis in ESL situation.

- We can measure temperature changes. – Active form
- It is possible to measure the temperature changes. – Impersonal Active form
- Temperature changes can be measured. – Passive form

The Imperative verb form is often used to give a series of instructions to operate, dismantle or assemble certain products in the fields of science and technology. The impersonal instructions are given using the verb in the present forms such as “consider, let, suppose, allow, assume, etc.” as exemplified below:

- Allow the water to cool for ten minutes and then note the temperature.
- Assume that there is no loss of heat from the boiler.

Imperative sentences are also constructed with the help of the verb “let.” Huddleton calls the imperative sentences used with “let” constructions as “Invitation type.” The use of plural imperative “let us” helps in involving the reader, and leads the
reader through the argument or discussion. This is frequently used in technical English and is very rarely found outside the register. The examples provided depict the use of these verb forms.

- Let the material be compressed so that the atoms move together an element of distance \( dr \ 0.2 \).
- As an example, assume an application utilizes an incrementing velocity profile as illustrated.

Modal verb forms such as “should” and “will” are employed for different purposes in the technical communication.

“Should” in technical English is used to give instructions to operators and employees, to give specifications, and of what is expected of something. The use of “should” depicting different functions is provided in the following examples.

- **Instruction**: The results of the experiment should be plotted on a graph.
- **Specification**: The maximum internal diameter should be 40 thousandth of an inch.
- **Expectation**: The process of cooling should continue for several hours.

The condition can also be expressed with the modal “should” as in the following example:

- **Should the temperature fall, condensation of the steam will result.**

“Will” in technical English expresses capability, and the routine processes which are otherwise conveyed using the simple present tense. Futurity, which is also expressed with the phrase “is going to” is not used in technical English.

- **Future**: Work will shortly begin on the new motorway. [The phrase “is going to” cannot substitute “will” to denote the futurity.]
- **Capability**: The rotor shaft will rotate at 30 r.p.m
- **Routine process**: Good lubrication will reduce the fiction.

### 3. CLAUSES

Clauses are very important in bringing about precision in technical writing. The frequent occurrences in technical writing are: different clauses both in Active and Passive form, the Conditional clauses that bring about the supposition or assumption and hypothesis. They are presented below.

#### 3.1. Relative clause

Technical writing employs a variety of sentences – often complex sentences with smaller units as phrases/clauses. Since clauses convey the sense of the sentence with an equal force of the entire sentence, the use of appropriate techniques can minimize wordiness and preserve the meaning. This can be achieved by the use of Relative clauses, both in Active and Passive forms.

3.1.1. The active relative

The relative clause used in Active form, is expressed by omitting the pronoun of the clause. This is done by using the “-ing” form of the verb as shown in the following two sentences (a) and (b) of the given example. However, the omission is possible only when the Present form of the verb is used in the clause.

- The man who operates the lathe is a skilled worker.
- The man operating the lathe is a skilled worker.

3.1.2. The passive relative

Technical English generally employs the use of the Passive form of the verb in Relative clauses which is further simplified by the contraction of the verb. The example below in sentence a) uses the relative clause “which” and sentence b) omits the use of “which.”

a) The petrol mixes with a stream of air which is blown over it.
b) The petrol mixes with a stream of air blown over it.

The Passive relative clause can be further expanded by using “so … thus” placed before the participle. This has an equivalent meaning of “in this way; in this manner.” The two sentences quoted below show the use of “so” or “thus” in a clause:

- The plates to be welded are placed between the electrodes, across which current is passed. The heat produced is sufficient to weld the plates together.
- The plates to be welded are placed between the electrodes, across which current is passed. The heat so produced/thus produced is sufficient to weld the plates together.

The use of Relative clauses aids in combining the sentences while the conditional statements help in bringing forth the possibility of a sequence of action in a process.
3.2. Conditional clauses

Conditional clauses are frequently used in the technical contexts. In the open conditional clause, placing the if-clause depends on the emphasis to be made:

- If current is passed through a solenoid, a magnetic field will be set up.
  (If –clause + main clause)
- The conveyor belt will be liable to slip off the drive if it stretches.
  (Main clause + if –clause)

As in general English, “if” clause is used to express the unreal and improbable conditions in technical English too. The example furnished below depicts the use of both the conditionals. In that situation, Perfect tense form is used:

- If the compressor blades were made of ordinary level, they would be unable to withstand very high temperatures. (Imaginary condition)
- If the concrete had not been sealed against the air, it would have dried out too quickly. (Unfulfilled past)

A normal if-clause + should is also used to denote possible conditions.

- If there should be an escape in high level radiation, it can be very dangerous.
- If the pipes should become too heavily corroded, they must be replaced.

Statements employing the “-ed”, “-ing” forms of the verb and the structures “only….if” and “given” can be used to express conditional statements, without the “if” clause.

- A reactor can be used to produce power provided an efficient …
- A reactor can be used to produce power only if an efficient heat – transfer…
- Given an efficient heat transfer, …

Clauses with the same subject are connected using the “-ing” form which can be otherwise explained with the use of “since.” The sentence (a) which is normally presented in two sentences could be written as sentence (b) making use of “ing” form.

a) This metal shows good resistance to corrosion. It forms a film of oxide which prevents corrosion.
b) This metal shows good resistance to corrosion forming a film of oxide preventing corrosion.

Clauses are also used to express the result or consequence of the first statement. The meaning of the sentences is emphasized further by the addition of “thus” or “thereby” which is an important aspect of technical writing.

- A variable resistance is led into the rotor, thus giving the motor a better starting torque.
- The excess air mixes with the products of combustion, thereby lowering the overall temperature.

Combining the clauses should contribute to coherence which can be achieved by using appropriate linkers.

4. LINKERS

Use of the Linkers facilitates the presentation of thought in a sequential manner and contributes to coherence. When a series of steps are performed in a sequence, which is very common in the fields of science and technology, they are denoted with the help of the Linkers/Cohesive devices that includes the conjuncts and adverbials. The sequence of events that show a cause and effect relation, clauses/sentences of the same subject are usually joined with the adverbials such as “before, after, as, while” etc. as denoted in the given example:

- Metal plates are prepared for a weld. But, first the metal plates are clamped together.
- Before the metal plates are prepared for a weld, they are clamped together.

Linkers also help in conveying the message of the statements very precisely. Sentences denoting the same subject can be further contracted by placing the adverbial in the initial position of the clause and using the “-ing” form of the verb. Adverbials such as “prior to, before, when, while, after, on” are employed in bringing about contraction in the statements. The example in sentences (a) and (b) depict the use of the adverbials.

a) Before it mixes with the products of combustion, the air is pre-heated.
b) Before mixing with the products of combustion, the air is pre-heated.

Converting a compound sentence into a simple sentence with a participle form and the right linker simplifies the expression. The use of some of the conjunctions contributing to coherence are “before, until, by the time, while, when, as, as soon
as, once, after, etc.” without using which the communication may become more wordy. The following paragraph reveals the use of the linkers in technical writing.

Before the piston reaches the top of its stroke, the mixture is ignited. It continues to burn until combustion is complete. By the time the piston reaches top dead centre, combustion is well under way. While any unburnt gas remains in the cylinder, combustion will continue. As combustion proceeds, the gases expand and drive the piston down. As soon as the piston reaches bottom dead centre, the exhaust valve is opened. When the piston nears the top of its stroke again, the inlet valve is opened. Once all the exhaust gases are driven out, the exhaust valve is closed. After one cycle is completed, another cycle begins.

The teaching and testing of the students in their use of linkers could be done through exercises with increasing complexity. 1. The use of cohesive words can be demonstrated using the paragraph as an activity by dictating the sentences in a random order and instructing the learners to sequence and connect them, taking hints from the linkers. 2. The same paragraph can also be given as a cloze exercise deleting the linkers and letting the learners choose the linkers from the list provided. 3. The complexity can be further increased by asking the learners to use appropriate linkers to which they should also provide an explanation.

This would ensure the use of linkers and also to sequence the events coherently.

5. CONCLUSION

Employing the appropriate syntax in technical writing renders precision and helps both in understanding the lecture listened to, and in reproducing it in the oral or written form. Technical writing is a different genre and demands ability to organize, synthesize, condense or elaborate facts and ideas from the learners; it also requires clarity and precision to attain objectivity which can be achieved by employing the aforementioned verb forms voice, clauses, linkers, etc. Thus, technical structures in the content acquire significance in the pedagogy to enable the learners to develop the required skill in communicating effectively. The use of these structures used frequently in technical English help

the learners express themselves efficiently both in oral and written communication in English.

REFERENCES