

An Analysis of Assignment Using Evaluative and Interpretative Information Processing: A Case Study of Selected Electrical Engineering Students

Siti Hazurah Indera Putera¹, *Zahari Abu Bakar¹, Kamaru Adzha Kadiran¹, Wan Suhaifiza W Ibrahim¹, Siti Musliha Ajmal Mokhtar¹, Siti Nurul 'Ain Zaiton²

¹Electrical Engineering Studies, College of Engineering, UiTM Cawangan Johor Kampus Pasir Gudang, ²Faculty of Applied Sciences, UiTM Cawangan Johor Kampus Pasir Gudang
Email: hazurah@uitm.edu.my, zahar311@uitm.edu.my, adzha7379@uitm.edu.my, wsuhaifiza@uitm.edu.my, sitim1300@uitm.edu.my, siti6687@uitm.edu.my
Corresponding Author Email: zahar311@uitm.edu.my

To Link this Article: <http://dx.doi.org/10.6007/IJARPED/v12-i3/19099>

DOI:10.6007/IJARPED/v12-i3/19099

Published Online: 18 September, 2023

Abstract

This case study scrutinizes the written assignment-handling proficiency of selected electrical engineering students by employing Reynders et al.'s rubrics, within the framework of Bereiter & Scardamalia's Knowledge Transforming and Knowledge Telling model. The research discerns distinctive cognitive approaches in good and weak writers, illuminating their performance in terms of evaluative and interpretative processing. Good writers exhibit a mastery of Knowledge Transforming, demonstrating creative thinking, critical analysis, and innovative problem-solving skills. Their assignments display originality and an adept integration of established knowledge with fresh insights. In contrast, weak writers lean towards Knowledge Telling, emphasizing the communication of existing information without substantial transformation. They may face difficulties in achieving analytical depth and adapting writing styles to different audiences. In addition, the use of writing assessment rubrics, such as the ones developed by Reynders et al., is also crucial. Students will benefit from having clear goals for their academic writing and receiving constructive criticism on their draughts.

Keywords: Knowledge Transforming, Knowledge Telling, Good Writers, Weak Writers, Electrical Engineering

Introduction

Background of Study

Writing is an important ability that is necessary for effective communication, furthering one's education, and advancing one's personal growth. However, not every writer is produced with the same amount of talent. Others have a difficult time articulating their views in a way that is clear, coherent, and powerful, while others are very good at conveying their thoughts.

Writing is a complex cognitive process that involves numerous stages and extensive mental operations. Despite the common perception that writing is a solitary activity, it is actually quite the opposite. Flower and Hayes (1981) put up a revolutionary concept that completely changed understanding of how individuals' approach and carry out the process of writing. A cognitive model that describes the various mental processes writers go through when they write is the Flower and Hayes (1981) model of the writing process. The model is predicated on the notion that writing is a complex, iterative process that entails planning, translating, and reviewing as can be seen in Figure 1.

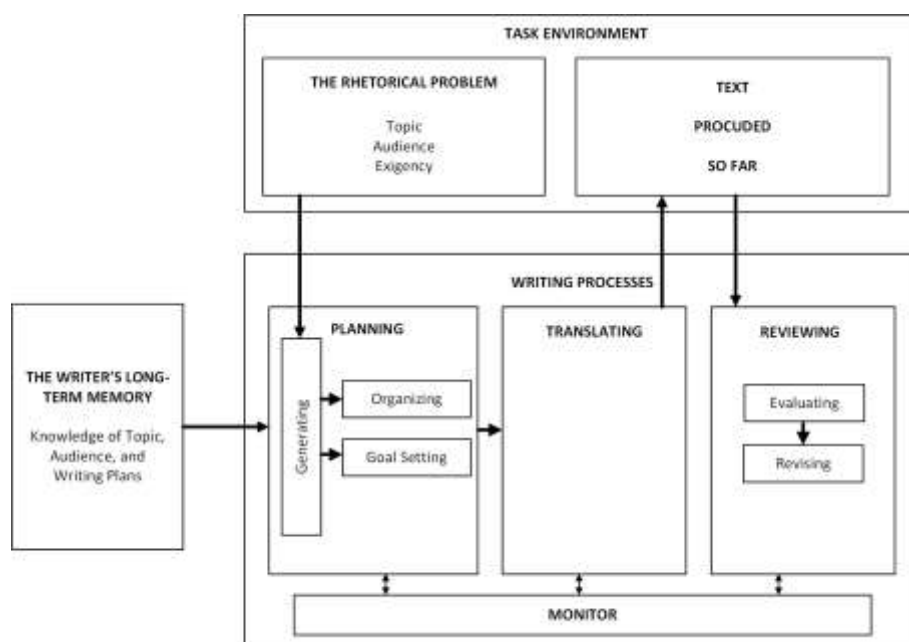


Figure 1- Writing Process
(adapted from Flower & Hayes, 1981)

Planning is the process of deciding what to write about and how to organise your ideas. This requires generating ideas (ideation), organizing, and goal-setting. In this phase, the writer may also engage in sessions of brainstorming, collect information pertinent to the work, and outline an outline of the structure of the piece. The process of translating is putting your thoughts into words. This entails utilising language skilfully and selecting the appropriate words to convey your meaning. Reviewing involves evaluating your writing and making any necessary changes. This includes checking for errors in grammar, spelling, and punctuation, as well as ensuring that the writing is clear, concise, and well-organized. This could also involve reorganizing ideas, refining language, adding or deleting content, and ensuring coherence and logical flow.

Flower and Hayes (1981) argue that these three processes are recursive, meaning that they can occur in any order and that writers may cycle back and forth between them as they write. For example, a writer may start by planning their essay, then begin translating their ideas into words, but then realize that they need to go back and revise their plan.

There are three key considerations in the Flower and Hayes (1981) model. To begin, there is the model's Dynamic and Recursive Nature, which highlights the fact that writing is not a sequential process. Instead, writers may switch back and forth between stages, returning to previous stages to revisit and revise their work as necessary. The model then moves on to Metacognition, where it emphasises the importance of metacognition, or the

ability to reflect on and regulate one's own thought processes. Writers must keep track of their own progress and make necessary adjustments. Finally, Task-Specific Adaptations are where the approach to writing can differ depending on the specific task, purpose, and audience. Writers may need to modify their strategies and approaches as a result.

In the context of engineering, students of engineering absolutely need to be able to communicate clearly and concisely in writing form. When presenting design concepts, technical reports, or the findings of research, having the ability to communicate complicated ideas in a way that is both clear and well organised is of the utmost importance. The model of the writing process that Flower and Hayes (1981) developed offers useful insights into the ways in which different people approach and carry out the work of writing.

Problem Statement

Previous research has demonstrated that engineering students frequently struggle with their writing abilities. As writing is an essential skill for engineers in their professional careers, this can pose a problem. According to Pushpa (2012), a large number of engineering students struggle with writing. Furthermore, it is found that these students, at least in the beginning stages of their course, do not develop the critical thinking skills necessary to improve. Students in engineering have a propensity to let the undeniable significance of oral communication in the workplace divert their attention from the value of good writing, despite the fact that this is not acceptable in the profession. The course will provide opportunities throughout the semester to focus on writing skills through the use of a variety of shorter written assignments. However, by adhering to some of the mechanics, stages of writing, and tips of writing as well as regularly practising their writing skills, one can improve the effectiveness of their writing.

Isnin (2018) states that the students' perceived level of technical writing competency showed the lowest mean score in terms of the skills associated with technical writing. This study was carried out with the purpose of investigating the technical writing competency needs that were perceived by Malaysian polytechnic engineering students in terms of knowledge, skills, and attitudes towards technical writing in English. However, the students were certain that there is a need to improve their technical writing competency, and they were aware that their ability to improve their technical writing competency is essential for their future career in engineering professions.

Objective and Research Question

The main objective of this study is:

- To investigate the writing skills of selected electrical engineering students through a writing assessment using information processing rubrics adapted from (Reynders et al., 2020).

The following questions are hoped to be answered by this research

1.3.1 How is evaluating done in electrical engineering students' assignment?

1.3.2 How is interpreting done in electrical engineering students' assignment?

1.3.3 How does the frequency of evaluative and interpretative components differ across learners?

Literature Review

Difficulties in Academic Writing

Bereiter & Scardamalia (1987) proposed a model of writing that distinguished between Knowledge Telling and Knowledge Transforming writing processes. These distinctions between experts (good) and novices (weak) were encapsulated by Bereiter & Scardamalia (1987) as a comparison between a knowledge-telling model of writing and a Knowledge Transforming model of writing. The extent to which content retrieval is strategically controlled to meet rhetorical objectives determines how ideas develop during writing, according to this model.

It is assumed that novice writers use a knowledge Telling strategy in which the organisation of the text is solely determined by the associations between the content as it is stored in long-term memory, with text production being guided by the direct retrieval of content from long-term memory. Transferring knowledge from one form to another, such as from one's mind to paper, is the definition of knowledge-telling. Knowledge-sharing writers focus on reiterating information they already know, without much reflection or analysis. They may use simple language and sentence structures, and they may not care much about their audience's needs. Figure 2 shows the knowledge-telling writing strategy by (Bereiter & Scardamalia, 1987).

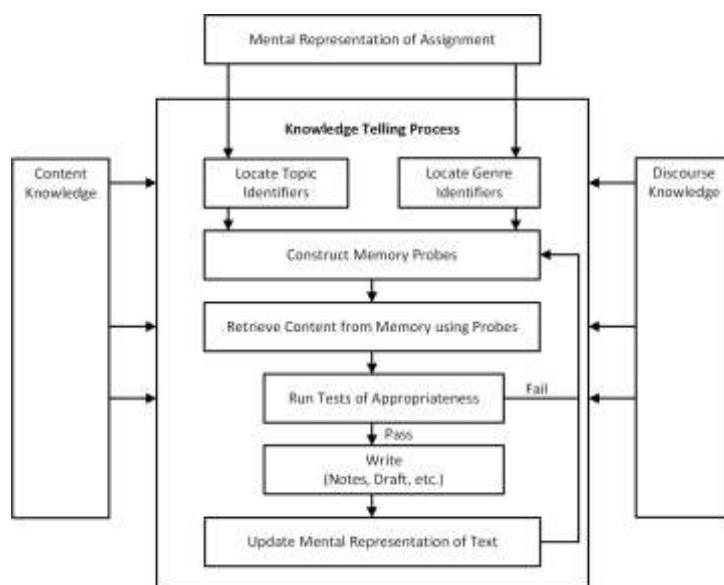


Figure 2- Knowledge Telling Model (adapted from Bereiter and Scardamalia, 1987)

A Knowledge Transforming strategy as can be seen in Figure 3, on the other hand, is used by more experienced writers. It entails developing a representation of the rhetorical or communicative issue that needs to be resolved and using the objectives deriving from this representation to direct the creation and assessment of content while writing. This strategy involved a fundamental shift in how the writer defined and approached the writing task, and that should not be viewed as merely an evolution of the Knowledge Telling model. As a result, while the Knowledge Telling model is still used to describe the process by which information is retrieved from memory, it is embedded within a dialectic between rhetorical and content problem spaces. Two aspects of the writing process are intended to be captured by this. First, it illustrates how ideas are presented in the text in terms of both their rhetorical function and as a reflection of the writer's knowledge (content space) (rhetorical space). Second, writing is

an emergent process in which content is formulated as the text develops rather than merely a matter of adapting the content to the rhetorical context. As a result, information is not only retrieved in response to a more detailed representation of the assignment as a rhetorical problem, but it is also created within the context of and as a contribution to the series of rhetorical acts that are gradually appearing in the text.

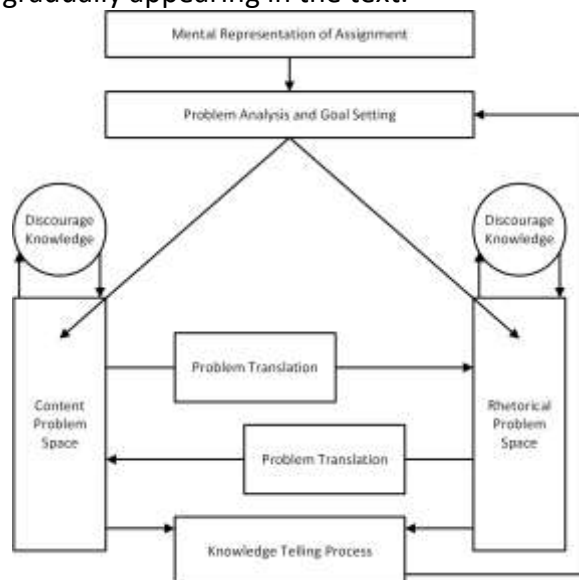


Figure 3- Knowledge Transforming Model (adapted from Bereiter and Scardamalia, 1987)

In their model of writing, Bereiter and Scardamalia (1987) argue that writing that involves knowledge transformation is more complex and requires more effort from the writer than writing that involves Knowledge Telling. Writers who focus on knowledge transformation need to be capable of juggling multiple objectives simultaneously, including the communication of their ideas, the engagement of their readers, and the cultivation of their own understanding of the subject matter. Additionally, Bereiter and Scardamalia (1987) assert that writing that involves knowledge transformation is more beneficial to the learning process. When writers transform their knowledge through the act of writing, it forces them to think critically about their own ideas and to consider other points of view. This can lead to a greater depth of comprehension as well as more sophisticated thought.

The model of good and weak writers developed by Bereiter and Scardamalia (1987) offers significant insights into the aspects that contribute to a writer's level of writing skill. This model provides a framework for understanding the essential qualities that distinguish proficient writers from less proficient ones. These characteristics distinguish proficient writers from those who are not as proficient.

Past Studies

Scholarly attention has been focused on the improvement of writing abilities for many years. Previous research on writing abilities has shed light on the complexity of this vital academic and professional skill. Writing's cognitive processes, pedagogical approaches, and the impact of technology on written communication have all been investigated by scholars through extensive research and in-depth analyses. These studies have not only expanded knowledge of efficient writing, but also made way for fresh approaches to education.

Aldabbus & Almansouri (2022) identified the significant challenges faced by some university students when writing academically. It is also discovered what hinders their

academic writing abilities. This study involved 36 English majors from the Faculty of Education. The research questions were addressed using a 25-item questionnaire. The data analysis showed that both graduate and undergraduate students struggle with some aspects of academic writing, including selecting the right academic words, coming up with a strong thesis statement, organising ideas, and creating paragraphs that make sense. These difficulties were influenced by a dearth of resources, followed by a limited command of the English language and a lack of opportunities for writing practise.

The difficulties college students have with academic writing were examined by (Sajjad et al., 2021). To achieve this, a qualitative descriptive analytic investigation was used. University students were given questionnaires to fill out to gather information. There are 40 students in the sample, 20 of whom are male and 20 females. The main conclusions demonstrate that students face a variety of difficulties when it comes to academic writing, particularly in terms of word choice, vocabulary, and paraphrasing.

The study by Rahmat (2020) examined the relationship between critical thinking skills and the writing process. 20 postgraduate students who participated in a research writing course had their free-text responses categorised according to the critical thinking skills they employed during the writing process. The findings have intriguing implications for the learning and instruction of academic writing for postgraduate students. The findings of this study will first demonstrate how writing mirrors the thought process. Second, the results of this study will encourage writing instructors to place equal emphasis on thinking and process when teaching writing.

Methodology

Research Design, Population and Sample

This research methodology employs a mixed-methods approach, incorporating both quantitative and qualitative research techniques, in order to investigate exhaustively the assignment-handling processes of our chosen participants. This methodological synthesis permits us to capture both quantitative metrics and nuanced qualitative aspects of student written assessment. The population is comprised of undergraduate students majoring in electrical engineering. This study involved the purposeful selection of 4 samples (2 weak writers and 2 weak writers). The rubrics provided by the resource person of the evaluated written assessment were used to assign grades to good and weak writers.

Instrument

Content analysis is a qualitative method that is utilized to analyse qualitative data. It was done on the written assessment the students had to complete. The content was coded using the written assessment's reoccurring patterns as the basis for classification. The instrument used is adapted from Reynders et al. (2020) and is presented in Table 1. The data will be then analyzed to obtain the frequency of evaluative and interpretative information processing.

Table 1

Information Processing Rubric (adapted from Reynders et al., 2020)

PROCESS	SUB-CATEGORY	DESCRIPTOR	CODE
Evaluating	Evidence	Show evidence	E-E
	Relevance	Indicating IF the information is relevant	E-If
		Indicating WHY the information is relevant	E-Why
Interpreting	Prior Knowledge	Interpret information using prior knowledge	I-Pk
	Explain	Explain the meaning of something	I-Ex
	Predictions	Match data predictions	I-Pr
	Patterns	Extract patterns from data	I-Pat
Manipulating or Transforming (Extent)	Extent	Display minimal manipulation of data	MTE-Min
		Display major manipulation of data	MTE-Maj
Manipulating or Transforming (Accuracy)	Accurate	Accurate manipulation of data	MTA-Acc
		Inaccurate manipulation of data	MTA-Inac

Evaluating and Interpreting are the two processes of information processing that are the primary focuses of this study, which was adapted from (Reynders et al., 2020). This research also adds a subcategory to each of these two processes. Table 2 shows evaluative and interpretative information processing used in this study.

Table 2

Evaluative and Interpretative Information Processing Rubric (adapted from Reynders et al., 2020)

PROCESS	SUB-CATEGORY	DESCRIPTOR	CODE
Evaluating	Evidence	Show evidence	E-E
	Relevance	Indicating IF the information is relevant	E-If
		Indicating IF the information is relevant (Weak)	E-If-Weak
		Indicating IF the information is relevant (Wrong)	E-If-Wrong
		Indicating WHY the information is relevant	E-Why
Interpreting	Explain	Explain the meaning of something	I-Ex
		Explain the meaning of something (Weak)	I-Ex-Weak

Findings

In the pursuit of understanding the intricate processes that underlie assignment handling among selected electrical engineering students, these findings stand as culmination

of empirical investigations. The findings presented herein provide a comprehensive insight into information processing skills that shape responses to written assignment task.

Findings for Evaluating

This section presents data to answer research question 1: How is evaluating done in electrical engineering students' assignment? In the context of this study, evaluation is sub-categorise into (a) Evidence and (b) Relevant. The writing skills of good writers will feature a significant amount of E-E, E-If, and E-Why constructions as can be seen in Figure 4.

4.0 Construction

Three layers of semiconductor material are used to create transistors, which are semiconductor devices. Bipolar junction transistors (BJTs) and field-effect transistors (FETs) are the two primary types of transistors.

Bipolar Junction Transistor (BJT):

NPN BJT: The design consists of an N-type emitter that is substantially doped with electrons, a P-type base that is lightly doped with electrons, and an N-type collector that is moderately doped with electrons between the emitter and the collector is the base.

PNP BJT: The design consists of a P-type emitter that is substantially doped with holes, an N-type base that is lightly doped with holes, and a P-type collector that is moderately doped with holes between the emitter and the collector is the base.

Field-Effect Transistor (FET):

N-channel FET: The design consists of an N-type channel that is doped with electrons, a P-type or insulating gate that is protected from the channel by a thin oxide layer, and an N-type drain that is only lightly doped with electrons make up an N-channel FET.

P-channel FET: The design consists of an N-type or insulating gate that is separated from the channel by a thin oxide layer, a P-type drain that is only lightly doped with holes, and a P-type source that is doped with holes.

data. When the transistor is turned off, the memory cell is unable to store data. This allows the computer to store and retrieve data from memory.

Transistors are used as switches in a wide variety of technologies, including computers, because they have a number of advantages over traditional mechanical switches.

- Transistors are much smaller and lighter than mechanical switches. This makes them ideal for use in portable devices, such as laptops and smartphones.
- Transistors are much faster than mechanical switches. This allows them to be used in high-speed applications, such as digital circuits.
- Transistors are much more reliable than mechanical switches. This makes them ideal for use in critical applications, such as medical devices.

In addition to these advantages, transistors are also relatively inexpensive to produce. This makes them a cost-effective choice for a wide variety of applications.

There are some examples of how transistors are used as switches in computers.

- Transistors are used to create the central processing unit (CPU). The CPU is the brain of the computer, and it is responsible for carrying out the instructions that are given to the computer. The CPU is made up of millions of transistors, which are used to create logic gates. Logic gates are the basic building blocks of digital circuits, and they can be used to perform a variety of operations, such as addition, subtraction, multiplication, and division.
- Transistors are used to create the memory. The memory is where the computer stores data. The memory is made up of millions of transistors, which are used to store bits of data. Bits of data are the smallest unit of data that can be stored in a computer.
- Transistors are used to create the graphics card. The graphics card is responsible for displaying images on the screen. The graphics card is made up of millions of transistors, which are used to create pixels. Pixels are the smallest unit of an image that can be displayed on a screen.
- Transistors are used to create the sound card. The sound card is responsible for playing sound. The sound card is made up of millions of transistors, which are used to create sound waves.

E-E

E-E

E-If

E-If

E-Why

E-Why

E-Why

E-Why

Figure 4- Good Writers' Samples for Evaluating

On the other hand, weak writers will make frequent use of E-If-Weak and E-If-Wrong in their written assignment as shown in Figure 5.

Amplifier which are one of the application of transistors. Transistors as an amplifier are named amplifier circuit which is used to amplify or enhanced input signals. The input of the amplifier is a voltage or current while the output is the input signal for amplifier. The application of transistor as an amplifier are limitless such as:

	MICROPHONE
	RADIO
	OPTICAL FIBRE COMMUNICATION

FIGURE 1

Configuration of Transistors, as mentioned before includes common emitter, common base and common collector. However not of these three configurations (common emitter is frequently used) due to its high gain. Common base configuration gain is less than 1 and Common Collector configuration gain is almost 1. Gain is the ratio of output Voltage to the input Voltage. Therefore, the suitable configuration for amplifier is common emitter.

E-If (Weak)

to be used capital letter.

briefly describe the operation of each application!

E-If (Wrong)

Figure 5- Weak Writers' Samples for Evaluating

Findings for Interpreting

This section presents data to answer research question 2: How is interpreting done in electrical engineering students' assignment? The term Interpreting will be broken down further into Explain only for the purposes of this investigation. Figure 6 demonstrates that good writers will have a significant amount of I-Ex in their writing, as shown in their abilities.

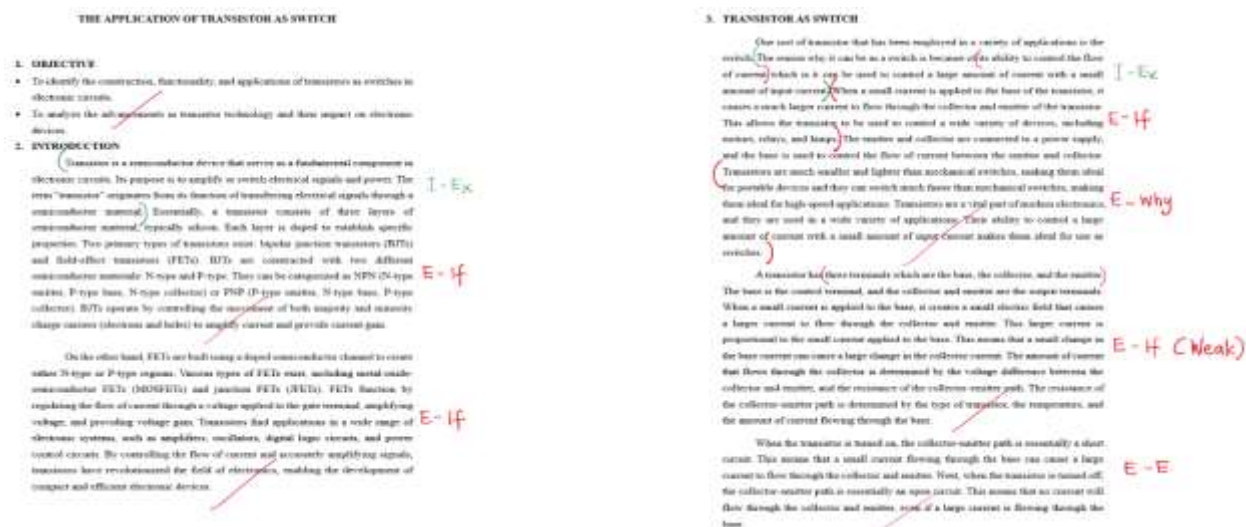


Figure 6- Good Writers' Samples for Interpreting

On the other hand, in their written assignments, weak writers will make frequent use of I-Ex-Weak as illustrated in Figure 7.

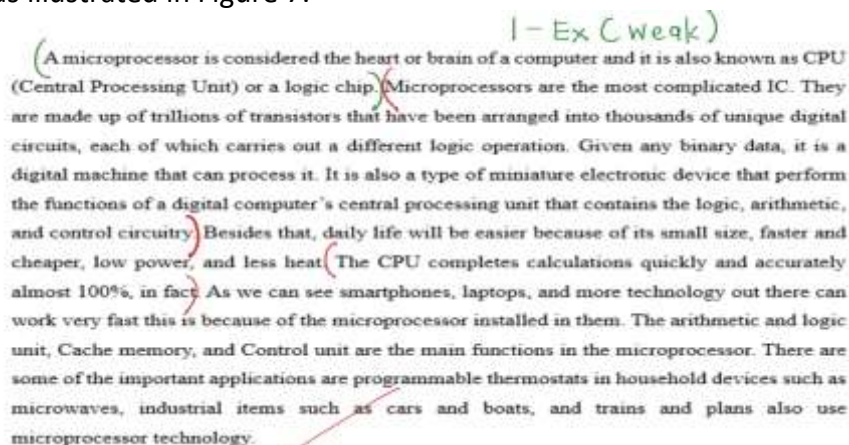


Figure 7- Weak Writers' Samples for Interpreting

Difference in the use of Evaluative and Interpretative Information Processing

This section presents data to answer research question 3: How does the frequency of evaluative and interpretative components differ across learners? This section is structured to provide a comprehensive overview of the frequency distributions, allowing for a systematic comparison of the utilization of evaluative and interpretative processing methods. Each category and subcategory will be presented with corresponding frequency counts, and percentages representations to facilitate a detailed examination of the data as can be seen in Table 3.

Table 3

Frequency of Evaluative and Interpretative Information Processing

NO	SUB-CATEGORY (CODE)	GOOD	WEAK
1	Evaluating		
a	Evidence (E-E)	4	1
b	Relevant (E-If)	22	1
c	Relevant (E-If-Weak)	2	3
d	Relevant (E-If-Wrong)	0	1
e	Relevant (E-Why)	10	0
	Total for Evaluating	38	6
	Percentage for Evaluating	74%	12%
2	Interpreting		
a	Explain (I-Ex)	4	0
b	Explain (I-Ex-Weak)	0	3
	Total for Interpreting	4	3
	Percentage for Interpreting	8%	6%
	Overall Percentage	82%	18%

Figure 8 depicts the overall percentage for the information processing used by good and weak writers. Good writers (82%) used more information processing compared to weak writers (18%). Information processing complies with knowledge-transforming by Bereiter and Scardamalia (1987). It can be seen that good writers apply knowledge-transformation writing of Bereiter and Scardamalia (1987) is more beneficial for learning. When writers transform their knowledge through writing, they are forced to think critically about their own ideas and to consider alternative perspectives. This can lead to deeper understanding and more sophisticated thinking.

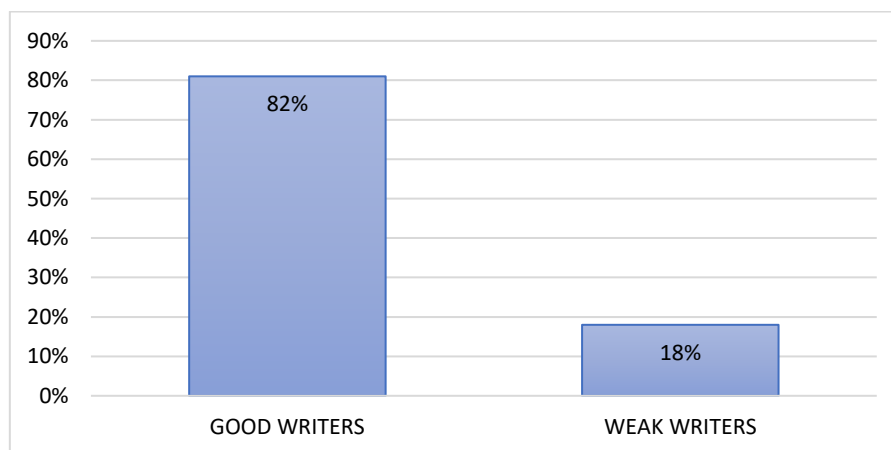


Figure 8- Comparison for Information Processing's for Good and Weak Writer

Figure 9 below shows the breakdown of evaluating and interpreting components used by good versus weak writers. Good writer used more evaluating (74%) compared to interpreting skills. Next, weak writers too used more evaluating (8%) compared to interpreting (5%).

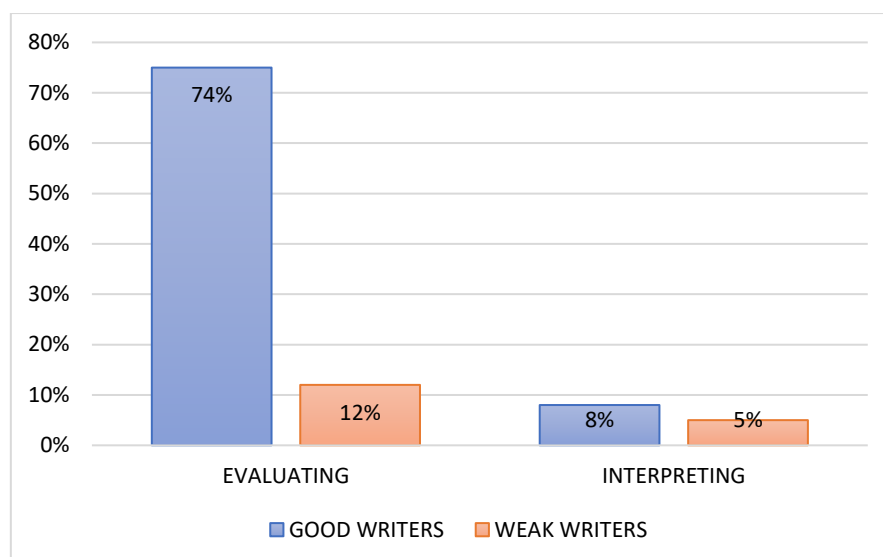


Figure 9-Comparison of Evaluating and Interpreting of Good and Weak Writers

Table 4 summarizes the key differences between good and weak writers in terms of their writing process.

Table 4

Summary of good and weak writers

Characteristic	Good writers	Weak writers
Writing process	Knowledge Transforming	Knowledge Telling
Focus	Developing understanding of the topic	Reproducing information
Engagement with the topic	Deeply engaged	Limited engagement
Audience awareness	Aware of audience and tailors writing to meet their needs	Not aware of audience or does not tailor writing to meet their needs
Reynders et al. (2020) Rubric Scores	Higher scores	Lower scores

Conclusion

Summary and Discussion

The Bereiter & Scardamalia (1987) model of Knowledge Transforming and Knowledge Telling is used to analyse written assignment handling among selected electrical engineering students. This provides valuable insights into the cognitive processes that underlie written assignment completion in this specialised field.

Good writers demonstrated a remarkable ability to generate original ideas, critically analyse information, and offer innovative solutions, as evidenced by their proficiency in knowledge-transforming. Their written assignments demonstrated a depth of comprehension by seamlessly integrating existing knowledge with novel insights. These individuals demonstrated a high level of adaptability and communication skill by adapting their writing style to diverse audiences and contexts.

On the other hand, weak writers, characterised by a focus on knowledge-telling, displayed a tendency to primarily convey existing knowledge without significant transformation or original contribution. Their assignments frequently lacked analytical depth,

and they struggled to adapt their writing to various audiences or purposes. These individuals could benefit from further development of their critical thinking and creativity when approaching writing assignments.

In conclusion, it is essential to note that the distinction between competent and incompetent writers is not indicative of general intelligence or skill. Instead, it emphasises differences in cognitive approaches to written assignments in the context of electrical engineering education. To promote the development of both groups, instructional strategies must be adapted to meet their particular requirements (Rahmat, 2023). Possibilities for advanced problem-solving and creative expression can be made available to improve the knowledge-transforming skills of proficient writers. For weak writers, targeted interventions focusing on critical thinking and the development of original insights can be implemented to facilitate their transition towards a more knowledge-transforming perspective.

Theoretical Contributions

Integration of Cognitive Processing Models: The paper makes a contribution by integrating the ideas of evaluative and interpretative information processing into the realm of assignment completion within the context of electrical engineering education. This integration provides a valuable understanding of the ways in which students engage with the coursework they are required to complete.

Application of Bereiter & Scardamalia's Models: This paper expands upon previously established theoretical frameworks by employing models developed by Bereiter and Scardamalia titled "Knowledge Telling" and "Knowledge Transforming." These models are extended into the context of electrical engineering assignments, demonstrating their applicability in a particular domain, as a result of this research.

Contextual Contributions

Insights into Electrical Engineering Education: This case study offers extremely helpful insights into the ways in which students in the field of electrical engineering approach their assignments. In the context of their particular field, it sheds light on their learning strategies, problem-solving techniques, and critical thinking skills.

Pedagogical Implications: The results of this research could have important pedagogical repercussions for educators working in the field of electrical engineering. It can be used to inform instructional strategies, the design of curricula and assignment structures, making it possible to more effectively cater to the cognitive processes and learning styles of students.

Enhanced Understanding of Knowledge Transformation: The paper advances understanding of how students in the field of electrical engineering may transition from knowledge telling (simply reproducing information) knowledge transforming by linking the study to Bereiter & Scardamalia's Knowledge Transforming model. This contributes to a better overall understanding of knowledge transformation (engaging in critical thinking and knowledge synthesis).

Potential for Generalization: Despite the fact that the study's primary focus was on students majoring in electrical engineering, the findings may have broader implications for students majoring in other technical fields or even for education in general. It is conceivable that it could act as a template for studies of a similar nature conducted in other fields.

Significance to Existing Knowledge

Augmented Application of Cognitive Models: This paper enhances the application of cognitive models such as evaluative and interpretative information processing within the context of educational assessment and the completion of assignments. As a result, the reader is provided with a deeper understanding of the processes by which students learn.

Enriched Understanding of Knowledge Transforming: The research improves understanding of how students in technical fields such as electrical engineering interact with and transform knowledge. This has the potential to contribute to the development of educational strategies that are more effective in these specialised areas.

References

- Aldabbus, S., & Almansouri, E. (2022). Academic Writing Difficulties Encountered by University EFL Learners. *British Journal of English Language Linguistics*, 10(3), 1–11. <https://doi.org/10.37745/bjel.2013/vol10n3111>
- Bereiter, C. & Scardamalia, M. (1987). *The Psychology of Written Composition*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Flower, L., & Hayes, J. R. (1981). A Cognitive Process Theory of Writing. *College Composition and Communication*, 32(4), 365. <https://doi.org/10.2307/356600>
- Pushpa, S. (2012). Effective Writing Skills For Engineering Students. *CONFLUENCE : The next Generation of Information Technology*, February, 238–244.
- Rahmat, N. H. (2020). Thinking about Thinking in Writing. *European Journal of Literature, Language and Linguistics Studies*, 3(4), 20–37. <https://doi.org/10.5281/zenodo.3620920>
- Rahmat, N. H. (2023). Writing about Writing: An Exploration of Types of Knowledge and Writing Difficulties. *International Journal of Academic Research in Business and Social Sciences*, 13(6). <https://doi.org/10.6007/ijarbss/v13-i6/17230>
- Reynders, G., Lantz, J., Ruder, S. M., Stanford, C. L., & Cole, R. S. (2020). Rubrics to assess critical thinking and information processing in undergraduate STEM courses. *International Journal of STEM Education*, 7(1). <https://doi.org/10.1186/s40594-020-00208-5>
- Isnin, S.F. (2018). Exploring the Needs of Technical Writing Competency in English among Polytechnic Engineering Students. *International Journal of Academic Research in Business and Social Sciences*, 7(12), 77–90. <https://doi.org/10.6007/ijarbss/v7-i12/3594>
- Sajjad, I., Sarwat, S., Imran, M., & Khuram Shahzad, S. (2021). Examining The Academic Writing Challenges Faced By University Students In Kfueit. *The Academic Writing Challenges Faced By University Students in Kfueit*. *Pjaee*, 18(10), 1759–1777.