Reducing Cogntive Overload in Online Academic Writing: A Case Study

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Abstract
One common denominator to academic writing no matter what level the writing piece is -is the also ability to write main ideas and support those main ideas. Another common denominator is the planning stage; all writers go through the planning stage. This composing process can be less difficult of writers use strategies when they compose. These strategies can be taught or scaffolded by the writing teachers. This study is therefore done to explore yet another way to teach academic writing online. Specifically, this study is done to explore how learners perceive the online composing process. This study is also done to explore approaches to reduce extraneous cognitive load and intrinsic cognitive load. In addition to that, this study also investigates if there is a relationship between composing process and cognitive load. 126 participants responded to a survey after undergoing a semester of academic writing with activities to reduce their cognitive load. Findings showed that learners were positive about the use of the activities to reduce their cognitive load. This study also revealed that there is also a moderate positive relationship between composing process and extraneous cognitive load. In addition to that, the findings also showed that there is also a moderate positive relationship between composing process and intrinsic cognitive load. Findings also bear interesting implications towards the teaching and learning of academic writing.
Keywords: Academic Writing, Composing Process, Scaffold, Extraneous Cognitive Load, Intrinsic Cognitive Load

Introduction
Background of Study
I have always been passionate about teaching academic writing. I have had the opportunity to teach academic writing at primary school level, secondary school level, then pre-university level, undergraduate level (both diploma and bachelor), postgraduate level to academicians. One common denominator to academic writing no matter what level the writing piece is -is the also ability to write main ideas and support those main ideas. Another common denominator is the planning stage; all writers go through the planning stage (whether they admitted they made plans for not).

I can safely say, the first stage of writing is the planning stage. This planning involves the writer thinking how he/she plans to respond to the title of the essay. It also involves how the writer plans to expand the main ideas that he/she have thought of. Flower and Hayes (1981) refer to the whole essay writing stage as the composing process.
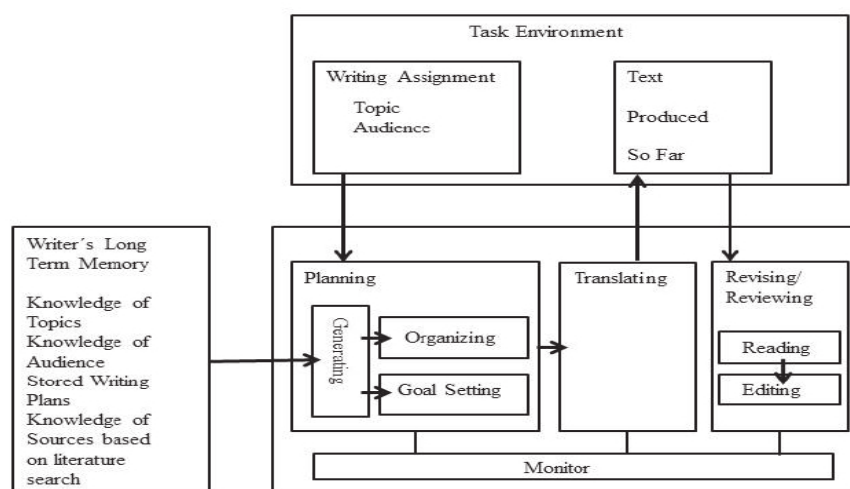

Figure 1- The Composing Process (source: Flower and Hayes, 1981)

With reference to figure 1 above, the composing process is seen as having three main phases. To begin with, upon getting the topic of the writing assignment, the writer begins by checking his/her long-term memory (background knowledge). This phase becomes less difficult when the writer has background knowledge of the topic, the audience (readers of the writing assignment), and also stored plans of the basic writing plan. In addition to that, in the time of internet, the writer also needs to have the knowledge of sources based on literature search. That is why a more experience writer finds sources easily on the internet compared to a non-experience writer. The former knows how or where to begin the search.

The next phase of the composing process is the "monitor" phase. This phase begins with the planning stage. Interestingly, the planning phase is facilitated by the previous stage-writer's long-term memory. The long-term memory helps the writer to generate the information, and then organizes and begins to set goals for the composing process. Once this stage is done, the writer is ready to embark on the translating stage. For many writers, this is the translation of oral thoughts into written thought. For the second language or the foreign language writers, this stage can involve the translation of the oral thoughts from his/her mother tongue to the target language as well. The last stage in the reviewing or revising stage. At the reviewing stage, the writer reads what he/she has written, and makes changes/edits.

One important last phase is the task environment phase. This may take place before the writer's long term memory phase or concurrently with the first stage. At this phase, the writer attends to the writing assignment by considering the topic of the of the essay and also the audience (reader) of the essay. As the writing progresses, the writer also constantly checks on the text produced so far. The double arrow to and from the translating and revising/reviewing stage shows the constant checking on the part of the writer.

Statement of Problem

What makes writing difficult is that composing involves phases. A writer may successfully complete one phase of the composing process, but may find problems with the following stages. According to Klimova (2014); Rahmat (2021), when writers write, they find difficulties

at different stages of their writing process. This is because different stages of the composing process requires different skills by the writer. Bulqiyah et.al (2021) reports that there are different types of problems with writing. The first problem is (a) affective problems where some writers need to deal with their attitudes towards learning writing. Next, writers also face (b) cognitive problems such as transferring language from oral thoughts into written thought and also, problems in the process of writing. In addition to that, according to Carolan & Kyppo (2015), a writer often overcomes the barriers to effective writing by acquiring strategies for independent, self-directed learning. These strategies can be taught or scaffolded by the writing teachers. As such, Napppu et al (2022) proposed that further research investigate prospects of approaches to facilitate learners learn academic writing online. This study is therefore done to explore yet another way to teach academic writing online. Specifically, this study is done to answer the following research questions;

- How do learners perceive the online composing process?
- How does extraneous cognitive load influence online writing?
- How does intrinsic cognitive load influence online writing?
- What is the relationship between composing process and cognitive load?

Literature Review
Writing Difficulty and Reducing Cognitive Load
In lieu of the fact that there are different reasons why writers find academic writing difficult, creative strategies can be introduced to the learners to facilitate the learning of writing; both face-to-face and online. One interesting way to reduce the burden to learning academic writing is by having activities that adhere to the cognitive load theory. This theory divides a person's working memory into three activity spaces: germane load, intrinsic and extraneous cognitive load (Sweller, 2011).

Firstly, learners experience germane cognitive load when they face difficulty integrating new information. This portion (germane load) of the memory involves the ability of the learner to make sense of new learning based on what they have stored in their schema. If the new information exists in the learner's schema (background knowledge), then the new learning can fit into the learners' memory easily. So, in order to make sure that writing assignments are not difficult, learners need to be given writing tasks that they had had background information on.

The next type of cognitive load is intrinsic cognitive load. This refers to the difficulty of the material itself. This load exerted on a learner depends on the difficulty of the task or concept that is presented, and a learner's ability to understand the new information. One way of reducing intrinsic cognitive load for writing tasks would be to allow learners to "share the burden" through group work. In addition to that, the task can be made less difficult when the writing teacher provides structure for the learners to follow. This makes the learners see the whole writing task as smaller, simpler steps.

The last type of cognitive load is extraneous cognitive load. This is the load generated by the way the material is presented and which does not aid in learning. This type of cognitive load is thereby produced by the demands imposed on the learners. This type of cognitive load is extraneous to the learning task, and is increased by ineffective teaching methods. There are many ways that the teacher can do to reduce extraneous cognitive load. Effective presentation methods can help reduce the extraneous cognitive load imposed on a learner. For example, some types of information are better understand when illustrated in a diagram,

as opposed to being written. One interesting way is to use graphic organisers in the composing process.

Past Studies on Learning Writing Online
A study was done by Ebadi and Alizadeh (2021) to investigate the effects of online-learner driven feedback (PDF) using Google Docs. It was also done to explore peer editing in a face-to-face classroom on EFL learners' writing skill. This study employed a quasi-experimental design. The participants were two groups of EFL learners consisting of twenty learners. Participants performed writing task 1 and task 2. Semi-structured interviews were carried out to explore the learners' perceptions towards the impact of online learner-driven peer-editing on writing tasks. An independent-samples t-test, along with two one-way MANCOVA, was used to analyse the quantitative data. The results showed that LDF-based peer-editing significantly enhanced the learners' academic writing skills, compared to the conventional in-class feedback. Thematic analysis showed t on the learners' positive perceptions towards the effect of online learner-driven peer-editing on academic writing skills.

Next, Vadia and Ciptaningrum (2019) conducted an action research study to improve students' writing skill. This is done by providing online feedback using Edmondo. This study consisted of two cycles or seven meetings altogether. The participants were 18 female midwifery students who enrolled in English for Academic Writing class. Quantitative data was obtained from writing test of descriptive text and narrative texts. Next, qualitative data was obtained from a semi-structured interview. Findings showed that the writing scores increased from pretest to posttest. The students also preferred teacher' feedback compared to peers' feedback.

Another study was done by Hoang & Hoang (2022) to investigate the possible effects of conducting regular collaborative activities via Google Docs in English academic writing skills. This study employed mixed-method design. The participants were 24 Vietnamese high school students. They were chosen as they enrolled in a fully online class on English as a foreign language (EFL) course in academic writing. Findings from pre-and post-test showed that the students' overall academic writing skills significantly improved. Specifically, there were improvements in the areas of task response and lexical resources. The areas of cohesion and coherence and grammatical range and accuracy did not witness significant improvements. Findings from the semi-structured interviews revealed that the participants valued the usefulness of Google Docs-based collaboration in enhancing their English academic writing skills.

Finally, Nappu, et.al (2022) carried out an experimental study to explore the impact of Google meet-based online learning on an Academic Writing course in the English Education Study Programme. The participants were 25 students. Information was gathered from a pre-test, a post-test and a questionnaire. Findings showed that the post-test scores increased. Findings also revealed that online learning through Google Meet on Academic Writing Course positively affects students' writing skills.

Conceptual Framework
Figure 1 below presents the conceptual framework of the study. This study is scaffolded from cognitive load theory by (Sweller, 2011). According to Sweller (2011), when learning, learners may be faced with extraneous cognitive load and intrinsic cognitive load. Learners are faced

with extraneous cognitive load when the difficulty is generated by the way the material is presented and which does not aid learning. Next, sometimes, learning a new topic becomes difficult because of the materials itself. This can be influenced by the learners' prior knowledge of the topic. In the context of this study, the two types of cognitive load is used to scaffold the factors that make help to make writing process less difficult, as revealed in figure 1 below. Writing process is measured by the categories by Flower and Hayes (1981) and they are (i) Planning, (ii) Translating and (iii) Reviewing. Next, in the context of this research, extraneous cognitive load can be reduced using graphic organisers (Huang, 2017). This is done by using mind maps and shapes. In addition to that, intrinsic cognitive load can be reduced by group work and structure (Beckhard, 1972). This is done through (i) Group work and (ii) Structure.
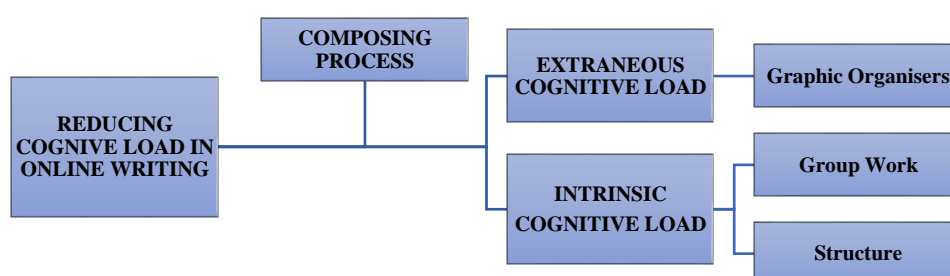

Figure 2- Conceptual Framework of the Study-Reducing Cognitive Overload in Online Writing

Methodology

This quantitative study is done to explore yet another approach to make learning academic writing less stressful. 126 respondents participated in this study. They are undergraduates who enrolled in a mixed mode academic writing class in a public university in Malaysia. The instrument (refer to table 1)used is a survey adapted from writing process by Flower and Hayes (1981), cognitive load theory by Sweller (2011) scaffolded onto graphic organisers (Huang, 2017) and also group work & structure (Beckhard, 1972). The items in the instrument is distributed in table 1 below. The survey has four sections. Section A has items on demographic profile. Section B as 23 items on writing process. Section C has 13 items on extraneous cognitive load while section D ahs 16 items on intrinsic cognitive load.

Table 1
Distribution of items in the survey

SECT	COGNTIVE LOAD THEORY (Sweller, 2011)	ONLINE WRITING & GROUP WORK	SUB-CATEGORIES	NO ITEMS	
B		WRITING PROCESS (Flower and Hayes , 1981)	Planning	8	
			Translating	8	
			Reviewing	7	
					23
C	Extraneous cognitive load	GRAPHIC ORGANISERS (Huang, 2017)	Mind Maps and Shapes	13	
					13
D	Intrinsic cognitive load	GROUP WORK & STRUCTURE (Beckhard, 1972)	Group Work	7	
			Structure	9	
					16
		TOTAL NUMBER OF ITEMS IN THE SURVEY			52

Table 2 below shows the reliability of the instrument. SPSS analysis showed a Cronbach Alpha of .944 for 52 items. This reveals a high reliability for the instrument.

Table 2- Reliability Statistics of the instrument

Cronbach's Alpha	N of Items
.944	52

Findings
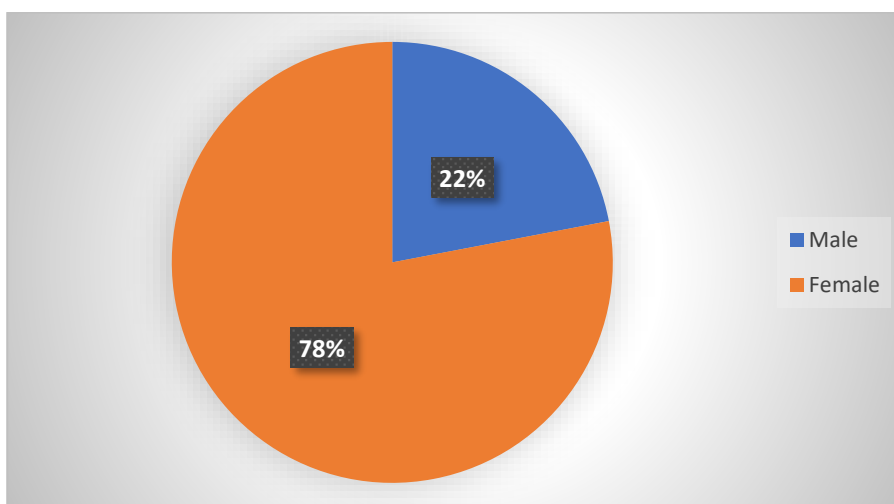Findings for Demographic Profile
Q1 Gender

Figure 3- Percentage for Gender
Figure 3 shows the percentage for gender. 22% of the respondents are male while 78% are female.

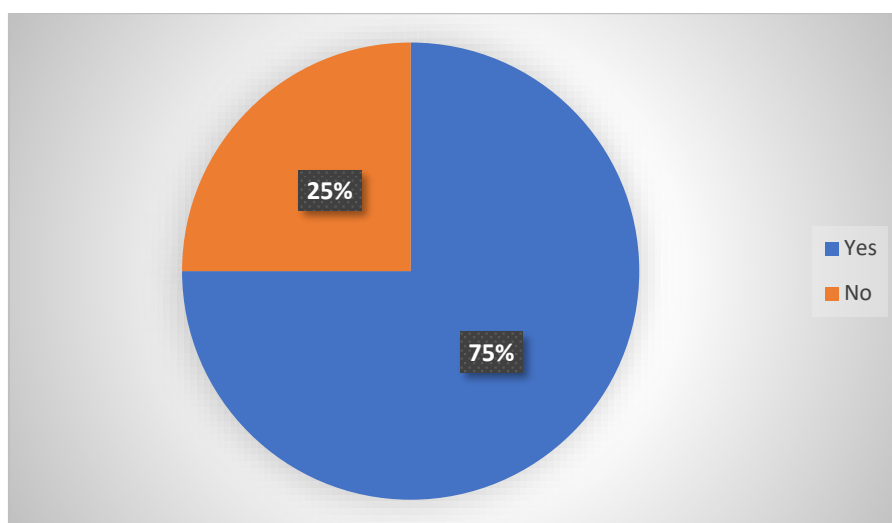Q2 Have you learnt Academic Writing with citations before this?

Figure 4- Percentage for Learning Citations
Figure 4 shows the percentage for learning of citations among the respondents. 75% admitted they had learnt citations. Meanwhile, 25% reported they have not learnt about citations.

Findings for Composing Process

This section presents data to answer research question 1- How do learners perceive the online composing process? The composing process involve the (i) planning phase, (ii) translation phase and also the (iii) reviewing phase.
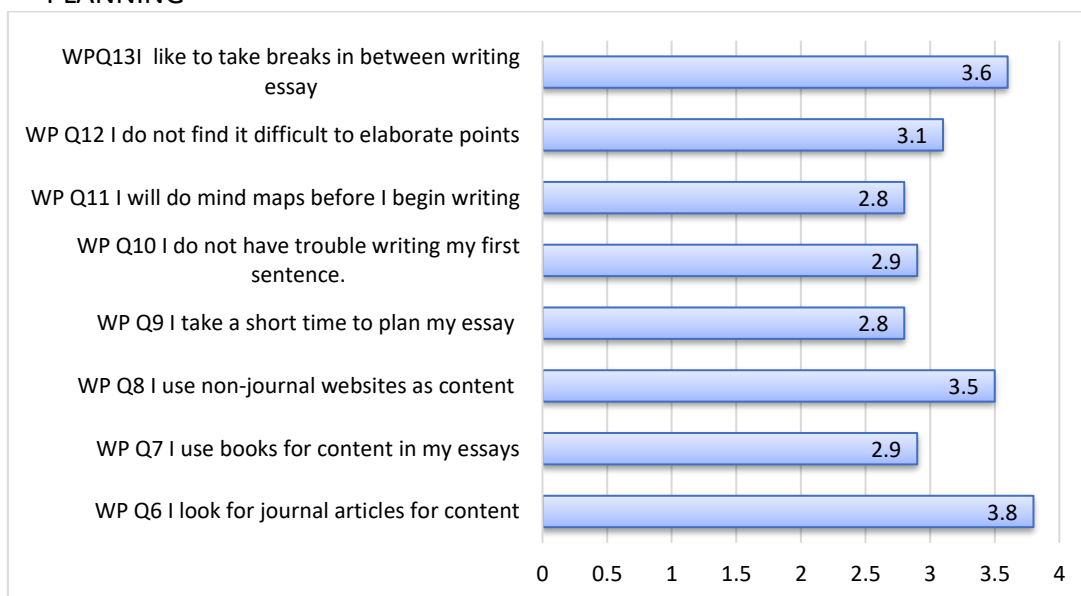
(i)   PLANNING

Figure 5- Mean for Planning

Figure 5 shows the mean for planning. The highest mean id 3.8 for the item "look for journal articles for content". This is followed by the mean of 3.6 for the item " like to take breaks in between writing essay". The item "use non-journal websites as content" had a mean of 3.5.
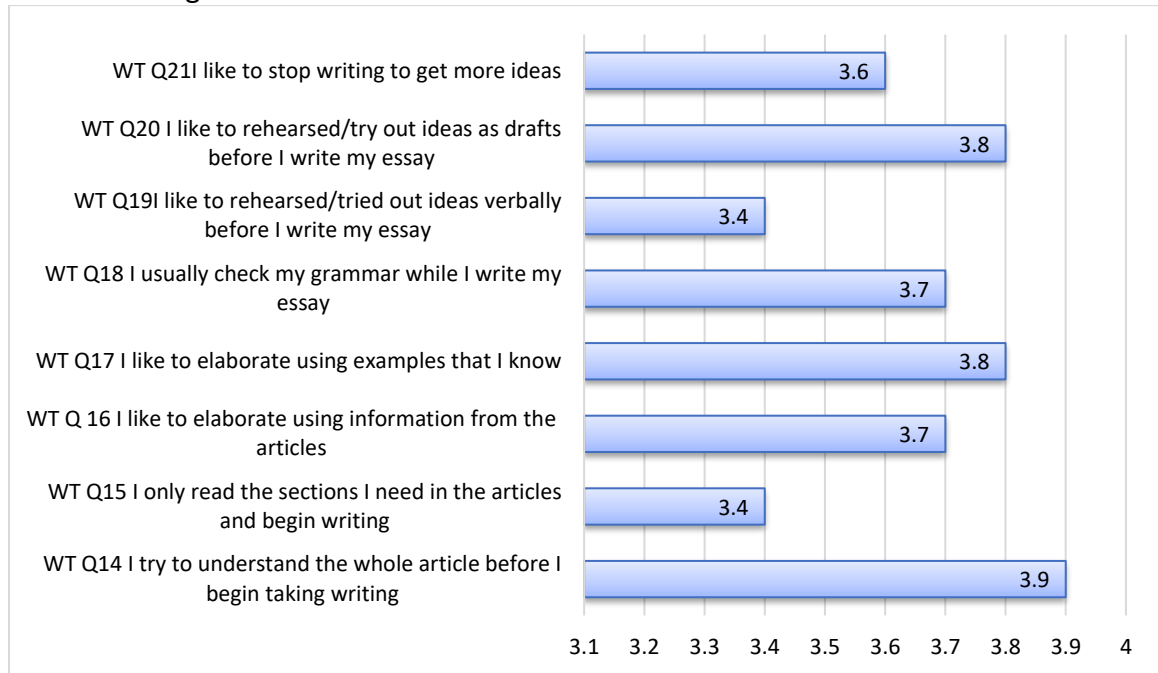
(ii)   Translating

Figure 6- Mean for Translating

Figure 6 shows the mean for translating. The highest mean is 3.9 for the item "I try to understand the whole article before I begin taking writing". Next, two items had the same mean of 3.8 and they are "like to elaborate using examples that I know" and "like to rehearsed/try out ideas as drafts before I write my essay".
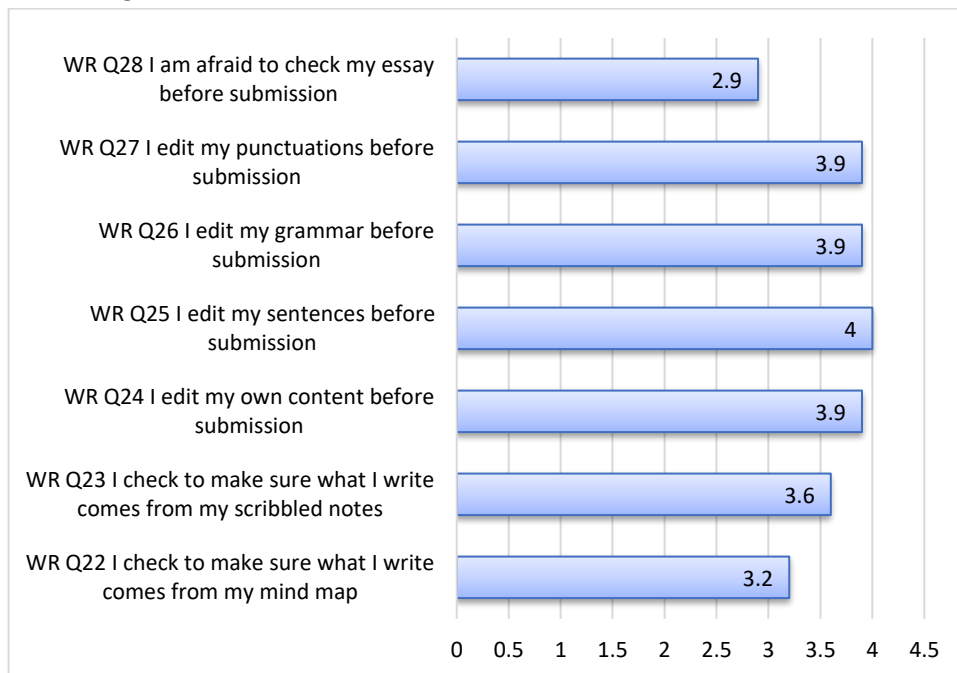
(iii)   REVIEWING

Figure 7- mean for Reviewing

Figure 7 shows the mean for reviewing. The highest mean is 4 for the item "edit my sentences before submission". Next, three items had the same mean of 3.9 and they are "check to make

sure what I write comes from my scribbled notes", "edit my grammar before submission" and "edit my punctuations before submission".

Findings for Extraneous Cognitive Load

This section presents data to answer research question 2- How does extraneous cognitive load influence online writing? In the context of this study, reducing extraneous cognitive load involves the use of scaffolds though graphic organisers such as mind maps and shapes.
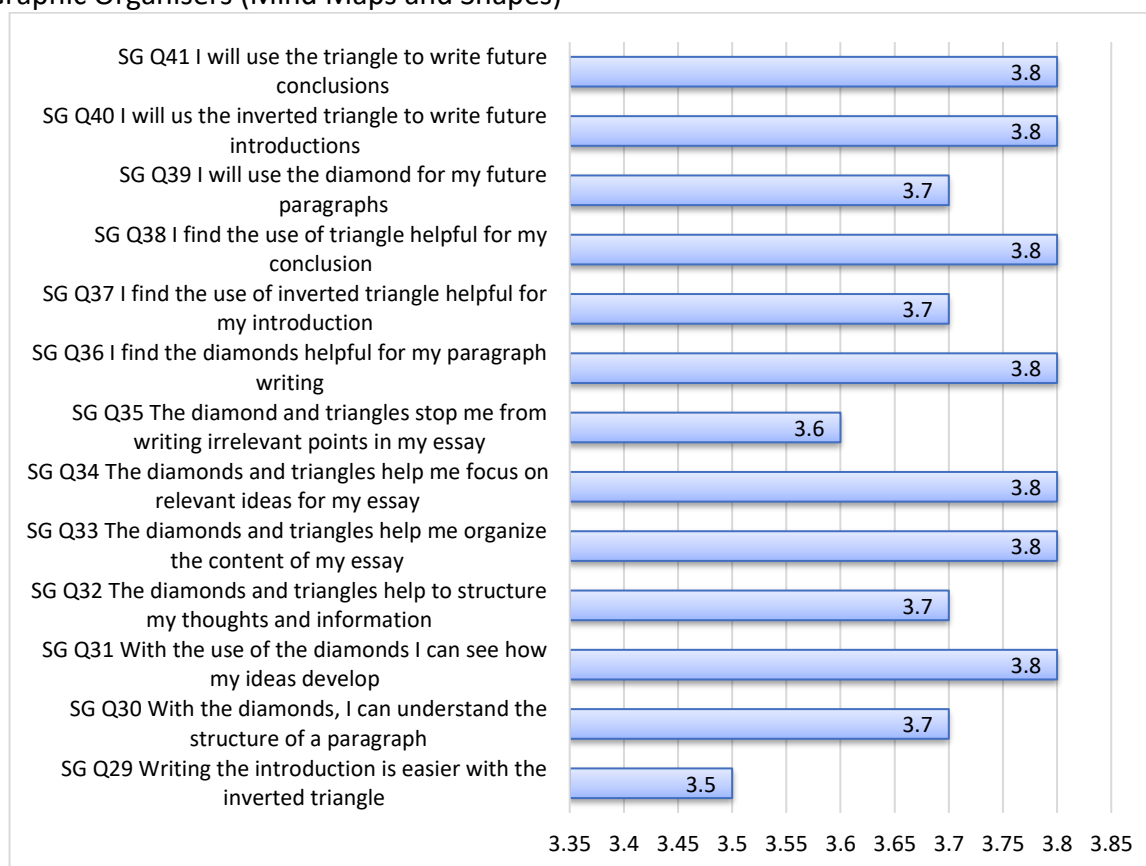
Graphic Organisers (Mind Maps and Shapes)

Figure 8- Mean for Graphic Organisers

Table 8 presents the mean for graphic organisers. Seven items share the same mean of 3.8. The items are "With the use of the diamonds I can see how my ideas develop", "The diamonds and triangles help me organize the content of my essay", "The diamonds and triangles help me focus on relevant ideas for my essay", "find the diamonds helpful for my paragraph writing"," find the use of triangle helpful for my conclusion", "will us the inverted triangle to write future introductions" and also "will use the triangle to write future conclusions".

Findings for Intrinsic Cognitive Load

This section presents data to answer research question 3- How does intrinsic cognitive load influence online writing? One way of reducing intrinsic cognitive load is by introducing smaller and simpler steps in learning activities to the learners. In the context of this study, reducing intrinsic cognitive load involves using (i) structure and group work as well as (ii) colour codes.

(i)   Structure & Group Work
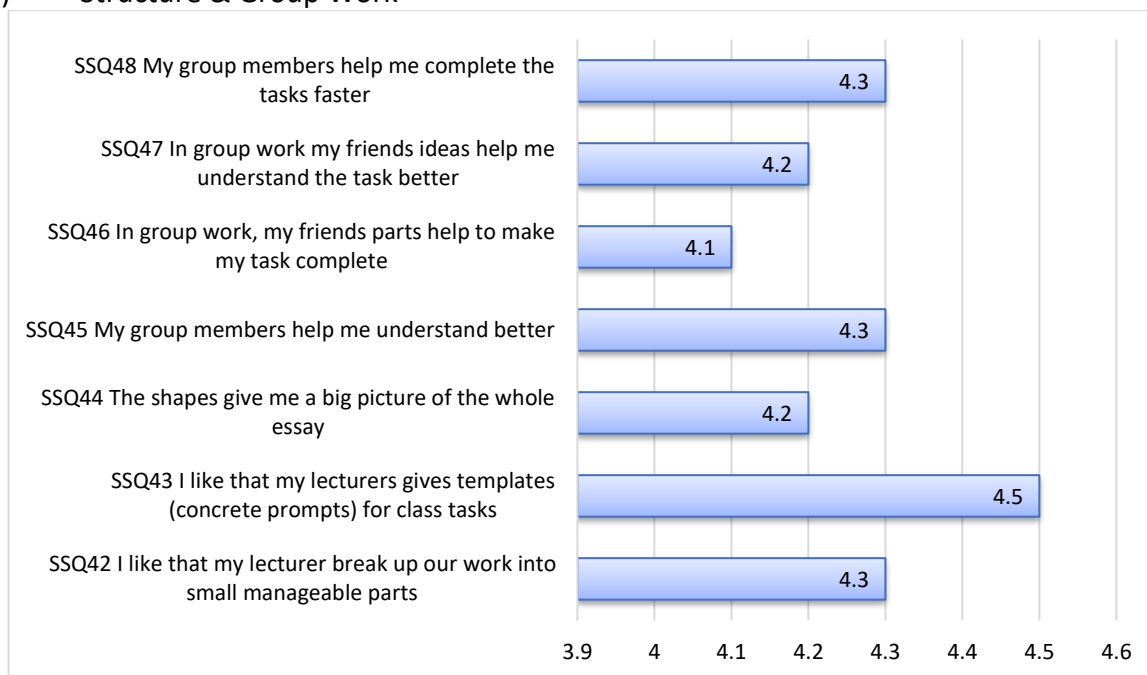
Figure 9- Mean for Structure & Group work

Figure 9 presents the mean for structure and group work. He highest mean is 4.5 for the item "I like that my lecturers gives templates (concrete prompts) for class tasks". Next, three items share the same mean of 4.3 and they are "I like that my lecturer break up our work into small manageable parts", "The shapes give me a big picture of the whole essay" and "My group members help me complete the tasks faster".

(ii)   Colour Codes

Figure 10- Mean for Colour Codes

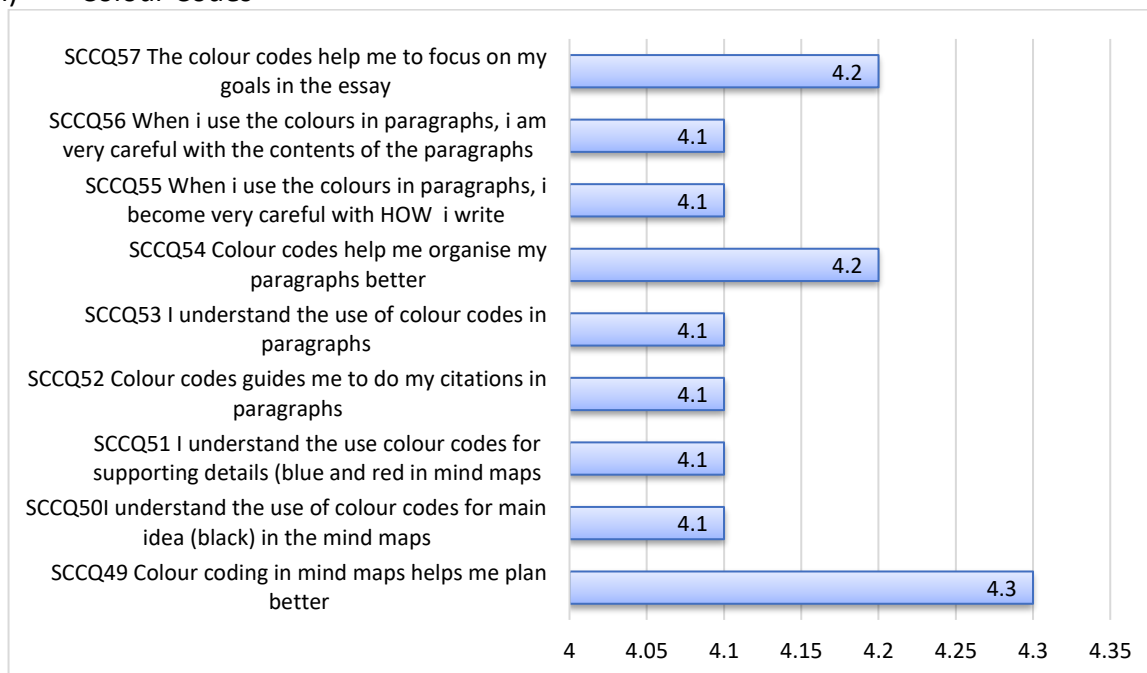Figure 10 shows the mean for colour codes. The highest mean is 4.3 for "Colour coding in mind maps helps me plan better". Next, two items share the same mean of 4.2 and they are "Colour codes help me organise my paragraphs better" and "The colour codes help me to focus on my goals in the essay".

Findings for Relationship between all three keywords
This section presents data to answer research question 4- What is the relationship between composing process and cognitive load?
To determine if there is a significant association in the mean scores between metacognitive, effort regulation, cognitive, social and affective strategies data is anlaysed using SPSS for correlations. Results are presented separately in table 3 and 4 below.

Table 3
Correlation between Composing & Extraneous Cognitive Load

Correlations

		TOTALCOMPOSING	TOTALEXTRANEOUS
TOTALCOMPOSING	Pearson Correlation	1	.408**
	Sig. (2-tailed)		.000
	N	126	126
TOTALEXTRANEOUS	Pearson Correlation	.408**	1
	Sig. (2-tailed)	.000	
	N	126	126

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3 shows there is an association between composing process and extraneous cognitive load. Correlation analysis shows that there is a high significant association between composing process and extraneous cognitive load. (r=.408**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and strong positive correlation from 0.5 to 1.0. This means that there is also a moderate positive relationship between composing process and extraneous cognitive load.

Table 4
Correlation between Composing & Intrinsic Cognitive Load

Correlations

		TOTALCOMPOSING	TOTALINTRINSIC
TOTALCOMPOSING	Pearson Correlation	1	.351[**]
	Sig. (2-tailed)		.000
	N	126	126
TOTALINTRINSIC	Pearson Correlation	.351[**]	1
	Sig. (2-tailed)	.000	
	N	126	126

[**]. Correlation is significant at the 0.01 level (2-tailed).

Table 4 shows there is an association between composing process and intrinsic cognitive load. Correlation analysis shows that there is a high significant association between composing process and intrinsic cognitive load. (r=.351**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and strong positive correlation from 0.5 to 1.0. This means that there is also a moderate positive relationship between composing process and intrinsic cognitive load.

Conclusion
Summary of Findings
In the context of this study, the composing process is a long process with several phases. When writers plan, they focus on what they can include in the content of the essay. The translation stage allowed writers to rehearse what they wanted to pun in written form. Writers perceived that reviewing is an important stage where writers edit their written task before the final submission stage. Writers felt that the use of graphic organisers in the composing process helped them depend of the structure of the composing process. They also felt that the colour codes used in their writing helped make the structure creative. This study is in accordance with the findings by Hoang & Hoang (2022) and also Nappu, et.al (2022) who also found that the structure such helped writers focus on desired goals in the composing process. In addition to that the group work throughout the composing process allowed the writers to complete their task faster. This findings is accordance with the studies by Ebadi and Alizadeh (2021); Vadia and Ciptaningrum (2019) who also reported that group work help ease the burden of the writers to complete the writing task. This study also revealed that there is also a moderate positive relationship between composing process and extraneous cognitive load. In addition to that, the findings also showed that there is also a moderate positive relationship between composing process and intrinsic cognitive load.

Pedagogical Implications and suggestion for Future Research
Learning academic writing whether face-to-face or online can be an overwhelming task for many. The composing process is a complicated as it involved many phases. This daunting task can be less stressful if writing teachers add creative techniques at the different phases of the

composing task. Writing teachers can prepare group interaction especially at the planning stage. Sharing the load truly helps to reduce learners' intrinsic cognitive load. Next, the use of structure like mind-maps, or even colour-codes help learners focus on what needs to be given attention to at one point in time of the composing process. This refocusing in non-word information helps to reduce extraneous cognitive load. Future researchers could explore interesting approach to teach academic writing to make writers feel that academic writing may be difficult but very doable.

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