



Writers on the Move: Visualizing Composing Processes Involved in Academic Writing

Alireza Ameri^{1*}, Zahra Pourniksefat²

¹ Faculty of Persian Literature and Foreign Languages, Islamic Azad University, South Tehran Branch, Tehran, Iran

² Faculty of Foreign Languages and Literature, Islamic Azad University, Science and Research Branch, Tehran, Iran

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Abstract

The present research study aimed to explore covert processes of editing and revision which were involved in writing four different academic text genres (i.e. abstract, conclusion, data commentary, and cover letter) in English language. To this end, six EFL learners with Persian as their mother were recruited to participate in this study. All the participants attended an induction session and each individual participant was invited to attend four writing sessions (total of 26 sessions for all 6 participants). Think-aloud protocol was employed for participants to verbalize all their thought processes, including stray notions, false starts, and incomplete or fragmentary thoughts, while performing the composition tasks. All the writing sessions were video-recorded and the participants were asked to insert their texts in Microsoft Word, which was in fact linked to the keystroke logging program, that is, Inputlog. The composition tasks were then dropped into Inputlog software to trim (i.e. reconstruct text production). The collected data were analyzed using qualitative content analysis as an interpretation and analysis method based on a three-step procedure proposed by Strauss and Corbin in grounded theory (open coding, axial coding, and selective coding). The results offered four main processes of planning, formulating, evaluating, and reformulating. The reformulating process was further subdivided into editing and revision. To draw a more accurate comparison between the processes, the researchers needed to resort to a statistical apparatus and run the Test of Chi Square. The results of chi-square indicated that there were significant but weak differences between the processes of editing and revision among different text genres. The results of the study would contribute to an understanding of how writing, editing and revising processes could integrate the learners into the process of academic writing.

Keywords: Academic text Genres, Editing, Inputlog, Revision, Think-aloud protocol

INTRODUCTION

The chronicle of research on writing proficiency substantiates that a well-authored piece of writing, irrespective of whether it is a poem,

rhapsody, or an academic essay, not exhibit itself as a fully-fledged composition from its inception. Yet, authors hone their writing style through the recursive rather than linear processes transpired during the crafting stage. What makes the problem of tracking writing

*Corresponding Author's Email:
a_ameri@azad.ac.ir



progress imponderable is the fact that much of the writer's maneuver is covert and imperceptible. Hence, all of what a research could postulate about the process of writing is generally attainable from the ultimate product whereby adopting a product-oriented approach seems to be largely favorable. With the advent of research on process writing, however, there has been a shift of emphasis from composition to composing (Arndt, 1987). Composing has been since considered a means of learning and discovery, which is a recursive, cyclical, and dynamic activity in nature (Flower L. & Hayes J., 1981)

Writing is one of the modes of verbal communication which necessitates that a writer be equipped with linguistic knowledge along with his/her communicative competence in construction of written discourse. Matsuda and Silva (2010) argued that writing entails three aspects which need to be taken into consideration by individual writers. It calls for considering the relationship among the elements of writing, the use of various strategies or heuristics for developing ideas, and the use of discursive repertoire (Matsuda & Silva, 2010). Gaining genre, in this regard, knowledge is of critical importance to assessing the rhetorical context in which writers are supposed to observe genre conventions and its values while constructing the written texts. More specifically in academic writing, it plays a pivotal role because the constraints and conventions of academic writing have posed difficulties for writers of any language.

Concerning professional and academic writing, Hyland (2006) argued that with the growth of English as the world's predominant language of research and scholarship, stemmed from the legacy of US and British colonialism, English academic writing has become a medium for documenting and communicating scientific knowledge. As a result, the hegemony of English language has exerted pressure on many scholars around the world to publish their re-

search in English-print publications. A plethora of research, in this regard, needs to be carried out in order to understand what is involved in production and publication of successful academic texts, which can range from studying writers' idiosyncrasies to the role of literacy mediators.

Editing and Revision Processes

One of the most influential models for expounding on how the composing process initiates is the one developed by Flower and Hayes (1981). They dissented from the stage model of writing which could only depict the composing process as a linear series of stages. Their cognitive model contained three core components including the task environment, the writer's long-term memory, and the writing process. The third component encompasses the very writing processes, specifically the basic processes of planning, translating, reviewing, and monitoring. They described reviewing as a reflective activity and subdivided it into a) reading, and b) editing. However, reading, generally regarded as revision, was later expanded and classified into different types of it (reading to comprehend, to evaluate, to define problems) in a new model proposed by Hayes in 1987 (as cited in Hayes, 2004). Meanwhile, a number of researchers proposed new models which showed that revision is triggered when writers notice a dissonance between the written text and the intended meanings, better known as dissonance models (Hayes, 2004).

Allal and Chanquoy (2004) posited that revision follows "an activity of reviewing, that is, of reading or (re)processing existing text or existing mental formulations of text...with the aim of evaluating the adequacy of text..." (p.2). Moreover, it should be noted that revision is not just error-oriented, and as Hayes (2004) puts it, "in many cases, we revise not because we discover a fault but we discover something better to say or find a better way to say what we have said" (p. 11).

Theoretical Foundation

The theoretical foundation of this study was based on two different models of viewing composing, that is, composing as a cognitive process and composing as conversation. Composing as a cognitive process derived from different models of writing which was initially proposed by Flower and Hayes (1981) for first language composing process as well as other studies conducted by Seow (2002) and Hayes (2004). The cognitive model proposed by Flower and Hayes contained three core components including the task environment, the writer's long-term memory, and the writing process. The third component encompasses the very writing processes, specifically the basic processes of planning, translating, reviewing, and monitoring. They described reviewing as a reflective activity and subdivided it into a) reading, and b) editing. However, reading, generally regarded as revision, was later expanded and classified into different types of it (reading to comprehend, to evaluate, to define problems) in a new model proposed by Hayes in 1987 (as cited in Hayes, 2004). Meanwhile, a number of researchers proposed new models which showed that revision is triggered when writers notice a dissonance between the written text and the intended meanings, better known as dissonance models. (Hayes, 2004). These studies in general identified recursive aspects of composing such as planning, organizing, drafting, and revising; focused on the differences between novice and expert writers; and suggested that processes vary according to the task, context, and writers' background (McCarthy, 2007).

Composing as conversation, however, had its root in Bruffee's (1984) and LeFevre's (1987) works. Bruffee (1984) proposed that thought is internalized conversation and composing is "internalized conversation re-externalized" (p.641). LeFevre (1987) in her study declared the following points regarding composing; a) the writer is usually influenced by the social context; b) writing norms and

genres build on knowledge from the past; c) writing may be enhanced by an imagined dialogue with another; d) writers involve others as editors, collaborators, and devil's advocates; and d) social context influences how texts are received, evaluated, and used (pp.33-35). In this regard, Hyland (2003) criticized process-based theory of writing for being merely discovery-oriented and ego-centered. He believed that this approach fails to consider the social forces outside the individual which influence writing because it could not properly explain how language works in human interaction.

Having these two models in mind, the researchers adopted a synthesis of these two different orientations and made a comparison between composing processes involved in writing, though they narrowed the scope of their comparison to academic text genres rather than literary or general ones. Moreover, the composing processes entail different processes of planning and formulating but the gathered data reduced through content analysis and the two processes of revision and editing were selected for further analysis.

Having considered the hegemonic position of the English language and the consequences it brings to English language pedagogy, the researchers deemed it suggestible that EFL learners be fed with fresh academic literacy skills, including reading, writing, and critical thinking. Considerable emphasis, however, needs to be placed on effective academic writing because it empowers EFL learners to share their scientific achievements and participate in academic settings. For the academic writing to be persuasive, writers need to effectively go through different writing processes, that is, to warily formulate their thoughts, make appropriate rhetorical choices, and revise the written text accordingly. The present study, therefore, aimed to explore covert processes involved in writing four different academic text genres, namely, abstract, conclusion, data commentary, and cover letter. Moreover, editing and revision processes were meticulously analyzed from

recorded thick data, which were elicited applying think-aloud protocols and keystroke logging program. To achieve the objective of the present study, the following research questions were posed:

1. What are the covert processes of editing and revision involved in writing different academic text genres in English language opted for by Iranian EFL learners?
2. (After the above question is addressed) To what extent the covert processes of editing and revision vary in writing different academic text genres?

Furthermore, in order for the researcher to be able to address the last research question the following null hypothesis was formulated:

H₀₁: There is no significant difference between the covert processes of editing and revision in writing different academic text genres.

METHODS

This study has favored qualitative and quantitative approaches. The rationale for adopting qualitative approach was the fact that this research was essentially exploratory and heuristic meaning that it was not concerned with testing theories and models. However, in order for the researchers to be able to make comparison between the processes involved, the researchers conducted statistical analysis at the end to accurately address the last research question. The researchers, furthermore, integrated grounded theory methodology with that of interpretive case study that has been defined as an in-depth examination of an example for the sake of optimizing understanding of the experiential knowledge. In doing so, the researchers

could incorporate the rigor and systematicity of grounded theory methodology into a case study research which has been pragmatically interpretive and exploratory. To ensure the trustworthiness of the present study, the researchers attempted triangulation which involves the use of multiple methods for collecting data. In addition to collecting data from think aloud protocols, Inputlog, as an unobtrusive research instrument, provided the researchers with more data for scrutinizing the processes participants went through during the composition tasks.

Participants

In this study, a total of 11 Iranian postgraduate students participated, five of whom took part in the first phase of the research, which was conducted to pilot research instruments, techniques and methods as well as to assess the feasibility of the research. They were native speakers of Persian who studied English as a foreign language and were selected through purposive sampling, which is widely used in qualitative research. Purposive sampling has different kinds (Palys, 2008), from among which criterion sampling was opted for by the researchers. Criterion sampling refers to the process through which the researcher selected cases or individuals who meet a certain criterion. In this regard, the researchers selected individuals who had the background knowledge about the academic text genres and were able to write in English language properly. In this study, each participant was given a specific name which shows his/her gender, task, and number. For instance, fW₁ means the first female writer and mW₁ means the first male writer. The demographics of the participants who took part in the main experiment are presented in the Table 1.

Table 1
The demographics of the research participants

NO.	Personal Info				Linguistic Background		Studying Experience		Educational Background		
	Name	Age	Ethnicity	Gender	L1	L2	L2	Degree	Level of Education	Field of Study	University Attended
1	fW ₁	27	Fars	Female	Persian	English	10	MA	Graduated	TEFL	IAU-STB, Iran
2	fW ₂	32	Fars	Female	Persian	English	10	MA	Graduated	TEFL	IAU-STB, Iran
3	fW ₃	32	Turk	Female	Persian	English	14	MA	Graduated	Translation	IAU-STB, Iran
4	mW ₁	29	Fars	Male	Persian	English	8	MA	Graduated	Translation	IAU-STB, Iran
5	mW ₂	27	Turk	Male	Persian	English	9	MA	Graduated	Creative Writing	City University, UK
6	mW ₃	29	Lur	Male	Persian	English	10	MA	Graduated	Translation	IAU-STB, Iran

Procedure

To attain the main objectives of the study, the researchers carried out the following research procedure, which is divided into two phases: Pilot Scheme and Main Experiment. In the first phase of the research, five participants attended think-aloud sessions in which they were supposed to write a 150-word paragraph for each text genre.

The results of the pilot study revealed that for the most part verbalizing and thinking aloud activity seems to be more obtrusive when it comes to assessing productive skills, that is, speaking and writing. With regard to writing, the participants only spoke the text aloud and seldom did they illuminate their thought processes. As a result, the researchers devised a pre-task activity in which the participants who were supposed to take part in the main experiment were instructed how to verbalize their thought and practiced it while composing a 150-word paragraph. Besides, the researchers provided the participants with a training film recorded by an expert writer that showed an act of thinking aloud during a cover letter composition.

What added to the rigors of the fieldwork was the presence of the camera that created a psychological barrier to some of the participants to vocalize their thought processes properly. To overcome the aforementioned hurdle—which could pose a threat to the cred-

itability of the study—the researchers decided to collect the main data with a less obtrusive instrument which was a keystroke logging program. The program that was in harmony with the aims of this research project was Inputlog, which was a research tool for logging and analyzing writing processes.

After the pilot study, six participants were selected for taking part in the main experiment and doing think-aloud tasks. In an attempt to identify the participants' proficiency level, the paper-based TOEFL Test was administered to each participant. They were allotted 110 minutes for completing this task. Moreover, they received writing guidelines (compiled by the researchers from different sources) on different academic text genres prior to starting the writing sessions. Due to the fact that it was impossible to run a think-aloud session in group, each participant needed to take part in each session individually. In total, the researchers recorded 25 writing sessions out of which 6 sessions were held for briefing the participants on the process of thinking-aloud during compositions, showing the training film, practicing think-aloud activity, and collecting the proficiency test.

While working on the writing tasks, the participants needed to verbalize all their thoughts as they normally would, including stray notions, false starts, and incomplete or fragmentary thoughts. For each task, the partic-

ipants needed to write a paragraph of 150-250 words. Although it was not a timed test as the time might impose further cognitive barrier on the participants, they were explained that they had at least 30 minutes for writing each task apart from the time allotted for reading the articles and prompts. There was an audio recorder near the participants, which recorded all their voices. While writing in English, the participants could verbalize their thoughts both in Persian and in English. All the writing sessions were video-recorded and the participants had to type their text in a commonly used software known as Microsoft Word which was in fact linked to the keystroke logging program.

It needs to be mentioned that, keystroke logging programs are designed to assist researchers in observing writing processes on a computer, which in fact reconstructs text production processes. There has been different keystroke logging programs among which Inputlog, Translog, and Scriptlog are the most widely used ones. However, each of these programs put the spotlight on one specific area. Inputlog is one of the most used keyloggers which enables researchers to observe the online writing process unobtrusively. It assisted the researchers in an in-depth analysis of the participants' performances. The program is available at <http://www.inputlog.net/>.

Materials

The four text genres that were chosen for this study were research article abstract and conclusion, data commentary, and cover letter. Regarding abstract and conclusion, two articles were selected. In the process of selecting the articles, the researchers considered novelty, multidimensionality, thematic diversity, and conceptual integrity of the articles. The longevity of journal and its editorial personality were also taken into consideration. For data commentary, the researchers selected one task from IELTS Academic Module Test. For the cover letter, the researchers checked online adver-

tisements and devised an authentic prompt for cover letter.

Data Analysis

The findings of this research were in fact based on the co-analysis of two sets of separate data analysis carried out on audio transcripts and Inputlog process data. Concerning the analysis of think-aloud protocols, each piece of data was transcribed verbatim by the researchers at first and then they went through content analysis based upon the codification procedure proposed by Strauss and Corbin (1998), that is, open coding, axial coding, and selective coding. The researchers transcribed each data twice in order for the reliability of the transcription procedure to be guaranteed. During the first transcription, however, the initial composing processes emerged from the data and the researchers gradually identified the processes and subprocesses that were involved in writing different academic text genres.

The process of analyzing think-aloud protocols in this research involved three steps. At first, the researchers transcribed the data and simultaneously, the very processes of composition derived from the data (open coding). Second, the researchers reexamined the transcriptions through colorcoding the obtained data (axial coding). Meanwhile, they gave priority to the processes of editing and revision and it was during the third step (selective coding) that the researchers reconsidered the processes and subprocesses and refined the emerged model.

Furthermore, the researchers conducted statistical analysis in order to examine whether the differences between the number of revision and editing processes were significantly meaningful or not. To this end, non-parametric test of Chi Square was run using SPSS software. In order to analyze and visualize writing processes, Inputlog offers different types of analyses among which the researchers selected summary, revision matrix and process graph. The summary logging file provided the researchers with general information about the writing pro-

cess, the writing product, process time, and the relation between the product and process information. The program also made it possible for the researchers to generate a process graph which is explained at length in the next section.

RESULTS AND DISCUSSION

Prior to describing the findings of the research, it is necessary to note that for this study 19

empirical data (19 English written texts) were collected and tabulated in Table 2. In this study, a single set of data included a written text composed in one specific text genre along with its writer's thought processes. As an example, six English abstracts were collected from the six participants but the total data, which were processed through content analysis, were 52 pages of transcriptions.

Table 2

Total data collected from each participant

	Abstract	Conclusion	Commentary	Cover Letter
fW ₁	*	*	*	*
fW ₂	*	*	*	*
fW ₃	*	*	*	*
mW ₁	*	*	*	*
mW ₂	*	-	-	*
mW ₃	*	-	-	-

Note. Data collected from each participant are marked with asterisks, but dashes indicate that the data were not collected and therefore are not reported.

Description of Composing Processes

As illustrated in Figure 1, the major composing processes derived from the content analysis of the data were the processes of planning, formulating, evaluating, and reformulating. The reason behind selecting such nomenclatures in progressive form was the fact that in so doing the researchers accentuated the recursive and dynamic nature of these processes.



Figure 1 Composing processes

The process of planning, as the word speaks for itself, involved the writers in thinking cogent-

ly about what to write and deciding carefully on how to write it. There is a subtle difference, however, between planning, outlining and brainstorming in that outlining is usually regarded as a kind of pre-task activity in which the writers provide a broad overview of their writing and brainstorming refers to an activity in which the writers brainstorm the ideas or even the words about which they want to write. Yet, planning was an iterative process which occurred during the writing task itself. At this recurrent stage, the participants carried out a sort of self-instruction and their thought processes revealed that they were mostly engaged in describing what they wanted to compose afterwards.

Samples Extracted from the Collected Data

- *I don't know whether to finish the sentence or to continue adding more information to this one. (Abstract)*
- *I am sensitive about the paragraph spacing so I'm gonna do something about that too (Data Commentary)*
- *I'm going to try to or in a way persuade him I mean I have to talk about my accomplishments and cre-*

dentials and what I have done (Cover Letter)

Formulating, which is known as an idea-generating stage, refers to a construct generated by the participants which was in itself the result of construing. Therefore, as can be discerned from the proposed model illustrated in Figure 2, the process of formulating comprised two subprocesses namely conceptualization and construction. At this juncture, the participants generated the main ideas and materialized them either synchronously or asynchronously. Part of this conceptualization could transpire during the planning stage that was largely based on the participants' personal preferences and their thinking style; however, it eventually culminated during the process of formulating. Having in mind that both conceptualization and construction are the components of the writers' cognitive processes, considering a clear-cut borderline between these two components is not straightforward. Moreover, demonstrating explicitly what has happened in their mind during the composition task has been quite complicated for investigation. The aforementioned complication arose from the fact that both of these subprocesses occurred in an abstract level whereby the researchers resorted to interpreting the ultimate product in order to be able to disclose the nature of these two subprocesses.

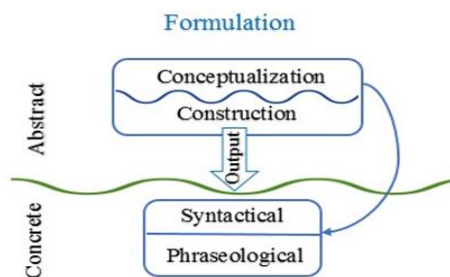


Figure 2 *Formulating process*

Consequently, the construction manifested itself in an output, which could be either syntactical or phraseological. Syntactical output was formed when the participants came up with a viable proposition in their mind and

completely produced an utterance. Conversely, phraseological output was either an un-formed proposition or an unstructured sentence which made the writers only produce a lexicon or a phrase.

Samples Extracted from the Collected Data

- *The study comma conducted on two hundred students revealed that [revealed that revealed that what?] (Conclusion)*
- *In response to the call for the lecturer in English [Okay! Okay! in response to the call for the lecturer in English] translation (Cover Letter)*

The next process being observed was the process of evaluating that was made through repeated reading and self-evaluation. In this process, the writers repeatedly reread the existing text in order to make sure whether the written texts were appropriate or not. Moreover, they rarely criticized themselves by having some self-talk concerning what had been written which is referred to as self-evaluation. It seems worthwhile to note that as the process of planning was a prospective move to conceive what should germinate in writing in general, evaluating was a retrospective endeavor in which the writers reflected upon what had already been constructed.

Samples Extracted from the Collected Data

- *this typology this taxonomy divided divided it this taxonomy divided it (Abstract)*
- *Let me rad it again (Conclusion)*
- *however about however about however about engineering engineering and programming about engineering and programming (Data Commentary)*

Reformulating, as self-explanatory as it is, refers to a process in which the participants returned to the text originally concocted by them and formulated it anew either through editing its surface or through revising its com-

position thoroughly. Looking back upon what had been proposed about the formulating process, the researchers propounded that the process of reformulating could also be constituted of two subprocesses, i.e., reconceptualization and reconstruction. If the writers reconceptualized what had been formed in their mind thoroughly, they would venture to revise the written text. However, if they wanted to reconstruct the written text, although what had been conceptualized at first remained intact, they would engage in editing processes.

Samples Extracted from the Collected Data

- *investigate is wrong I should write to find out maybe (Abstract)*
- *let me change the awareness of with the impact of teaching (Conclusion)*
- *I should capitalize the first word (Data Commentary)*
- *assume is not the perfect word for that (Cover Letter)*

Concerning the time allotted to each of the four composing processes, it was observed that in general the six participants spent much of their time on formulating, self-instructing and repeated reading respectively and less frequently did they immerse themselves in reformulating, that is, editing and revision. However, it seems worthwhile to note that in particular each participant allocated the time to each of the above noted processes quite differently which was particularly pertinent to their writing style. As an example, one of the participants (fW₂) spent an inordinate amount of time on self-instructing while the composing processes of mW₃ were inundated with repeated readings of the filler type.

Pendulum Effect in Writing

The pendulum effect discovered by Galileo Galilei who described the swinging motion of a pendulum by the force of gravity and acquired momentum can be extrapolated to the motions of processes involved in writing. The researchers believe that the back-and-forth motions of writ-

ing processes could be analogous to a swinging pendulum wherein the writers go through the planning and formulating processes when the pendulum displaces and swings forth. However, it is in its reversive move that the writers step into the evaluating and reformulating processes respectively. These reiterative processes will proceed until the writers accomplish the composition task and the pendulum rests in its equilibrium position.

Analysis of Editing and Revision Processes

As mentioned above, this study primarily focused on revision and editing processes that were two subdivisions of reformulating process. The reason that the researchers at first analyzed all four processes in detail lay in the fact that reformulating was a reiterative process that sporadically transpired during different phases of writing process. Thus, as the researchers observed, reformulating can be classified according to the time of its occurrence into initial, medial and terminal reformulations.

Initial reformulations, which could take place during the planning phase, are those changes that directly influence the mental formulation of the text. These changes are not directly observable and they could be made through either revision or editing processes resulting from reconceptualization or reconstruction of the text's conceptual content. Medial reformulation, however, refers to the amendments the participants made during the time of formulating process that was by itself divided into mid-formulation and post-formulation amendments. Unlike medial reformulation, terminal reformulation bears upon final reading when the participants made their final revision to the written text. Mid-formulation amendments refer to those changes that occurred in the time of transcribing the concocted text and post-formulation changes happen after the time of transcribing while writers repeatedly read the written text.

Figure 3 represents the classification of reformulating process. As can be seen, reformu-

lation is approached from two different angles with respect to the time of its occurrence and the target the writers intended to meet. Time-wise, reformulation can transpire initially, medially or terminally which was thoroughly explained in the previous paragraph. Target-wise, it might take place so as to improve either the attractiveness or adequateness of the written text indicating whether the change was made through editing processes or through

revision ones. In other words, if the writers had an aim to improve the attractiveness and effectiveness of their writing they would reconstruct the written text through editing processes. On the contrary, if they conceived that the written texts were not in harmony with the intended meanings they would venture revision processes. Based on the target the participants set, substitution, for instance, can be both editing and revision.

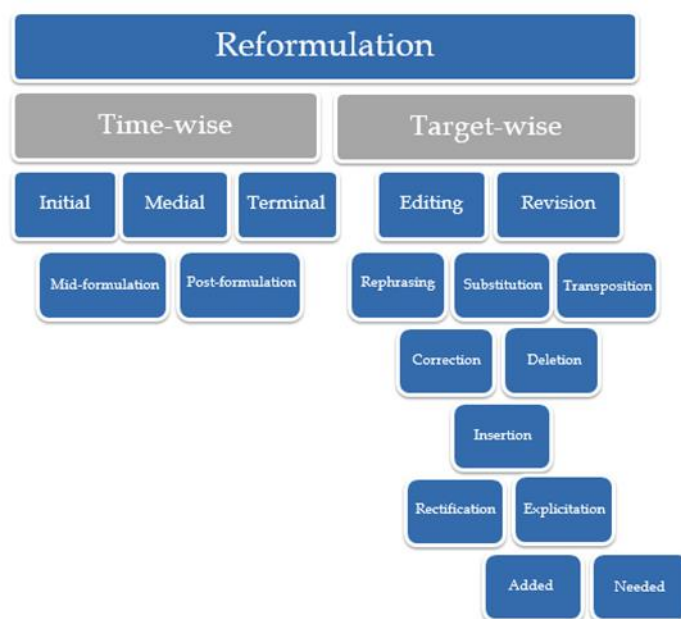


Figure 3 The researchers' classification of reformulating process

Editing and revision are divided into six subprocesses, namely insertion, deletion, substitution, transposition, rephrasing, and capitalization and orthographic correction that could occur during medial and terminal reformulating processes. Insertion refers to the process through which the writer inserts an appendage (e.g. a word, a phrase, or even a punctuation mark) to the stretch of a sentence or a clause for the purpose of either explicitation or rectification. In other words, the appendage might be added in order to clarify the written sentence and/or to specify the information provided which is labeled as explicitation.

The term explicitation—here, an interdisciplinary borrowing—is originally grounded in translation studies that was described by Vinay and Darbelnet in 1958 as "the process of

introducing information into the target language which is present only implicitly in the source language, but which can be derived from the context or the situation" (as Cited in Pym, 2005). By inserting an appendage to a sentence writers attempted to make explicit what remained implicit or ill-defined in the written sentence. For example, in her English cover letter, fW₁ inserted *namely TOEFL and IELTS* during post-formulation process or she inlaid *functional translation theories* in her English conclusion during terminal reformulations.

Insertion for the sake of explicitation is considered both a revision and editing process which is in itself divisible into two types—added explicitation and needed explicitation. The former does not necessarily add new in-

formation to the text but the latter does. For instance, mW₂ inserted *they are rarely good icebreakers* and *in our research* in his English abstract during medial reformulations which are needed explicitation and added explicitation respectively. Moreover, insertion in lieu of rectification is an attempt to regulate and calibrate the accuracy of the written text through inserting grammatical appendages such as preposition and punctuation.

Deleting can be regarded as both revision and editing processes. Depending on their purpose, the participants deleted part of the written text because they had revised the whole concept and sometimes they did it so as to remove inaccuracies or redundancies. Like deletion, substitution can also be considered revising as well as editing process. It is executed during medial and terminal reformulation referring to a process through which the participants attempt to substitute an expression with an alternative. This alternative is usually selected from the same category that the expression belongs to such as synonymy or hyponymy category. However, the alternative was adjusted because the writers intended to add formality or even beauty to the written text. For example, fW₂ substituted *in this article* with *in this research* during the mid-formulation phase of her English abstract reformulating process; however, she substituted *cooperation is so important* with *cooperation plays a pivotal role* during its post-formulation phase so as to add formality to the written text. In general, substitution is a stylistic change because it improves the text effectiveness and attractiveness; nonetheless, if it attaches specific meaning to the written text it is regarded as a revision process. For instance, *Oxbridge of Journalism* was replaced with its hypernym *City University* in order to add specific meaning to the written text.

In contrast to substitution in which the writers substitute one alternative with another one (for example A instead of B), in transposition the participants transpose two sentences, which

had been produced beforehand, with each other that are not from the same category (for example A and B are replaced). While substitution transpired at word level, transposition generally took place at clause and sentence levels. In both his abstract and cover letter, mW₂ transposed the written sentences and clauses with each other during its medial reformulations. The next reformulating process being observed was rephrasing in which the participants rephrases the written text in another way (for example A is rephrased into A'). Rephrasing process does not add any meaning to the written text, hence, it can be categorized as an editing process.

In addition to the abovementioned processes, two other types of editing were observed among the participant writers, namely, reediting and misediting. In reediting process, writers edit or revise the edited text once again; however, in misediting being less frequent than reediting, the participants edited the text in order to improve its effectiveness but the ultimate result deviates from the accepted norms. As an example, mW₂ in his English abstract substituted *volunteer less frequently* with *shy away* which is not an acceptable term to be written for an academic genre although it might be correct in itself. In other words, misediting displayed the error of appropriacy rather than accuracy.

In-depth Analysis of Editing and Revision Processes

Table 3 below shows the number of words produced by each participant, the number of words that have remained in the final document after it had undergone some changes, the number of pauses each participant had and the produced ratio, which shows the ratio of the product to the process, and it means that if this number is one, no change has taken place. The total time spent by the participants for completing this task is presented in the abovementioned table.

Table 3*Summary analysis of English abstracts*

	Number of Words Produced	Number of Words in Final Doc	Number of Pauses	Produced Ratio	Total Process Time
fW ₁	266	251	72	0.92	00:35:00
fW ₂	239	190	57	0.73	00:32:38
fW ₃	243	205	33	0.92	00:20:22
mW ₁	199	160	86	0.74	00:30:38
mW ₂	474	226	115	0.47	01:10:00
mW ₃	253	158	84	0.53	00:38:00

A simple look at Table 3 reveals that the abstracts were written within the average number of 198 words; however, the abstract written by one of the participants (fW₁) was highly above this average (251). It also indicates that the average time spent by each participant on writing the abstract was about 30 minutes. Nevertheless, one of the participants (mW₂) completed the task inordinately. It should be noted that part of this amount of time was allocated to the pauses the participants had during their writing and as can be seen in the above-noted table fW₃ had the lowest number of pauses (33) and mW₂ applied the highest number of pauses and gaps (115) from among the participants. Regarding the number of pauses, it should be noted that Inputlog automatically reports the pauses of more than 5 seconds. However, the researchers did not thoroughly analyze them because it was beyond the scope of this research.

Another point, which is particularly noteworthy about Table 3, is the differences that exist between the number of words produced during the process of writing and the number of words that have remained in the final scripts. Comparing these two groups of numbers with each other, the abovementioned table shows that mW₂ and mW₃ had the maximum differences among the participants which were 248 and 95 respectively. The higher the difference, the lower the ratio and according to Inputlog's manual the low number would mean more revisions. That is, those participants who had

more insertions and deletions they made more revisions to their text. Finally, the software provided the researchers with the process graph of each of the six participants which is the graphical representations of the way they wrote their abstracts.

Through scrutinizing each participants' performance on this task, it can be stated that in writing English abstracts, the participants could be represented in a continuum between the most linear writer to the most nonlinear writer. In this regard, fW₁ and fW₃ could be considered the most linear writers who spent the least amount of time on introducing modifications to the written text. Then, fW₂ and mW₁ composed their abstracts quite nonlinearly and made more adjustments to their text in comparison to fW₁ and fW₃. At the end of this continuum stand mW₂ and mW₃ who made the highest number of modifications to their text in terms of both editing and revision processes. Concerning the reformulating processes undertaken, it can be stated that the participants made most number of changes to the written texts through insertion and substitution.

Samples Extracted from the Collected Data

- *the present article* → *in the present study* → *this research* (*Substitution*)
- *among Iranian students* (*Insertion*)
- *aims to outline* → *aims at outlining* (*Rephrasing*)

- *the following are among the most significant result (Deletion)*

Table 4 below presents the summary analysis of the conclusions written by four out of six participants. As can be seen in 4 conclusions were written in approximately 22 minutes, except for one of the male participants (mW1) who completed the task in 28 minutes. The

average number of words produced during composition was about 166 words; however, fW3 exceeded this number. Comparing the number of words produced during the composition with the number of words that have remained in the final scripts, it can be said that two of the participants gained the maximum difference which consequently affected their obtained ratios.

Table 4
Summary Analysis of English Conclusions

	Number of Words Produced	Number of Words in Final Doc	Number of Pauses	Produced Ratio	Total Process Time
fW ₁	157	144	39	0.89	00:21:34
fW ₂	186	157	38	0.87	00:21:34
fW ₃	255	190	31	0.77	00:21:49
mW ₁	254	174	49	0.60	00:28:06
mW ₂	-	-	-	-	-
mW ₃	-	-	-	-	-

Note. Dashes indicate that the data were not collected and therefore are not reported

In sum, it can be elucidated that in writing a 150-word conclusion the participants largely comported themselves in a nonlinear way which means that they were frequently engaged in reformulating process. Moreover, about 82 percent of these amendments were editing processes which mostly took place during medial reformulation and included a considerable portion of substitution and deletion. For the most part, the participants' revising processes involved insertion of appendages for the sake of explicitation.

Samples Extracted from the Collected Data

- *it indicates → shows → demonstrates (Substitution)*
- *which studied the functional theories (Insertion)*
- *post-test (Deletion)*

Table 5 below summarizes the analysis of data commentaries which were written by four participants in approximately 21 minutes. One of the participants (fW₁), however, spent an inordinate amount of time to complete this task. As can be seen, three data commentaries were written with the average of 155 words, but the data commentary written by fW₁ outnumbered the other ones (312). Comparing the number of words produced during the composition task with the number of words that have remained in the final scripts, it can be said that mW₁ reduced more number of words during the composition task.

Table 5
Summary Analysis of English Data Commentary

	Number of Words Produced	Number of Words in Final Doc	Number of Pauses	Produced Ratio	Total Process Time
fW ₁	344	312	65	0.87	00:36:45
fW ₂	177	156	22	0.88	00:20:47
fW ₃	194	152	31	0.82	00:21:41
mW ₁	220	158	45	0.58	00:22:20
mW ₂	-	-	-	-	-
mW ₃	-	-	-	-	-

Note. Dashes indicate that the data were not collected and therefore are not reported

To conclude, it can be indicated that data commentaries were also written nonlinearly; however, in comparison to other three genres it was observed that all the participants ventured their formulations quite phraseologically owing to the hallmark of the genre itself. Furthermore, 19 percent of the participants' reformulating processes were inserting appendages to the written text for the purpose of explicitation and about 81 percent of these amendments entailed editing processes including correction of capitalization and orthography as well as insertion of appendages for the sake of rectification and added explicitation.

Samples Extracted from the Collected Data

- *question mark (Insertion for the sake of rectification)*
- *also (Added Explicitation)*
- *the maximum number of students (Needed Explicitation)*

Table 6 below gives the summary analysis of the cover letters that each participant composed. Five cover letters were collected from the six participants, and as can be seen, the participants differed from one another in terms of time allocation. One of the participants (mW₂) wrote a 257-word cover letter in approximately 19 minutes while another participant (fW₂) wrote a cover letter of 185 words in 29 minutes. Having lasted about 55 minutes, writing of fW₃ is the longest cover letter among the other participants, and during its composition, she had 114 pauses. Considering the difference existing between the numbers of words produced during the compositions and the number of words that have remained in the final scripts, it can be said that mW₂ and mW₁ have gained the maximum difference which are 121 and 70 respectively.

Table 6
Summary Analysis of English Cover Letter

	Number of Words Produced	Number of Words in Final Doc	Number of Pauses	Produced Ratio	Total Process Time
fW ₁	396	364	71	0.91	00:31:03
fW ₂	199	185	39	0.87	00:29:07
fW ₃	534	430	114	0.83	00:55:00
mW ₁	293	223	38	0.73	00:25:47
mW ₂	378	257	34	0.64	00:19:19
mW ₃	-	-	-	-	-

Note. Dashes indicate that the data were not collected and therefore are not reported

Regardless of the data collected from mW₂—who left out writing sessions untimely—it can be concluded that cover letters of the other four participants were composed more nonlinearly in contrast to the other genres. Their reformulating amendments mostly involved editing processes (about 72 percent) among which substituting and rephrasing were very conspicuous. Furthermore, 68 percent of these editing processes were executed during medial reformulations. In this genre, the participants revised the written text through inserting appendages for the sake of explicitation, deletion and transposition.

Samples Extracted from the Collected Data

- *extremely prestigious (Deletion)*
- *a lecturer of writing (Needed Explicitation)*

- *with a title → entitled (Substitution)*
- *a lot of research (Deletion)*

Visualizing Composing Processes

As stated above, Inputlog provided the researchers with process graphs which indicated the composing process of each participant. This section elaborates on the performance of two of participants as the most notable examples. In these figures, the blue line shows the total text production as a cumulative number of characters produced at different intervals, and the green line indicates the actual length of the script at every interval, which gradually increases and sometimes decreases when text is deleted. Finally, the cursor position is represented by the dotted line which is an indication of the (non-) linearity of the process.

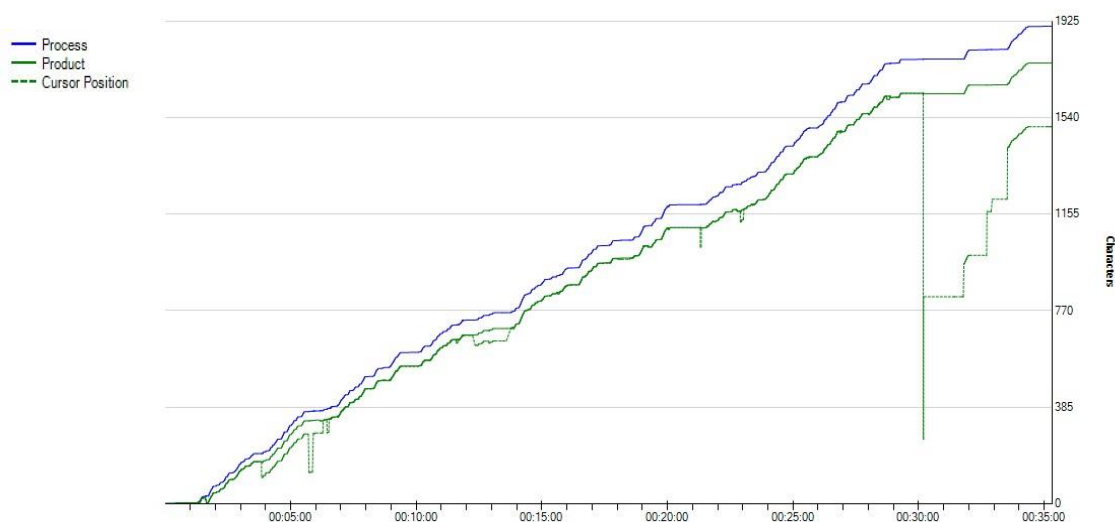


Figure 4 Graphical representation of composing process of fW₁ (Abstract)

Figure 4 above shows that the composing process of fW₁ was clearly linear and her writing process lasted for about 35 minutes. Her text gradually grows throughout that period and she made only few modifications to the original text. Concerning the processes involved, this participant spent much of the time on syntactical formulating and repeated reading. In comparison with the other participants, fW₁ executed relatively few self-instructions and hence her writing process could be characterized by limited

interaction between planning and formulating phase which may reflect the knowledge-telling strategy proposed by Bereiter and Scardamalia in 1987 (cited in Alamargot and Chanquoy, 2001). Her medial reformulations involved substitution which mostly happened in mid-formulation phase. During the last 8 minutes, she started final reading which was for the purpose of evaluating the written text whereby she made only few revision to her text through inserting an appendage and editing some typing errors.

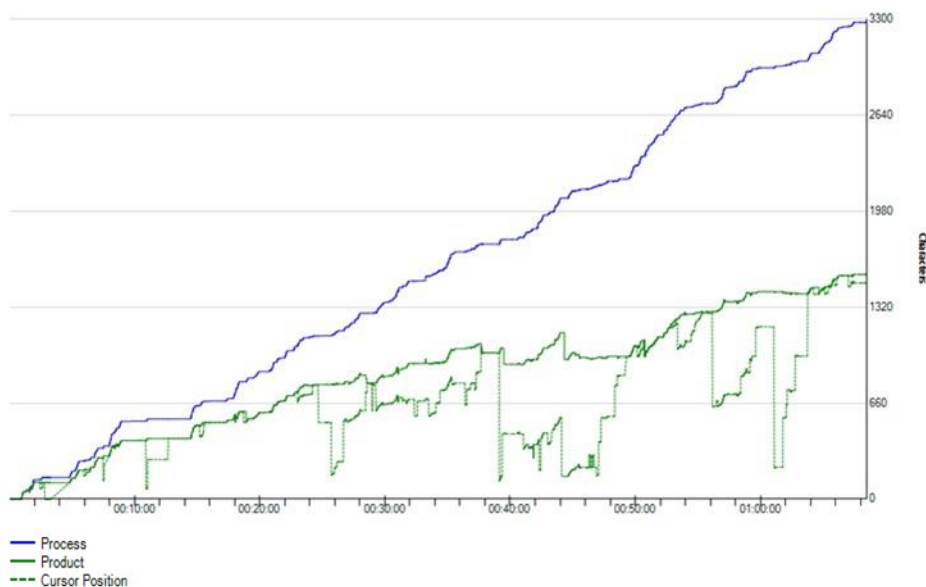


Figure 5 Graphical representations of composing process of mW₂ (Abstract)

Figure 5 above shows the composing process of mW₂ who obtained the ratio of 0.47 meaning that this participant made the most number of changes to his text in comparison to the other participants. As can be seen from the abovementioned graph, his composing process was quite nonlinear indicating that he constantly reverted to the produced text during the composition task. With regard to the writing processes that he engaged in, it was observed that this participant moderately executed some sort of self-instruction. However, he frequently formulated different versions of a sentence before deciding on the most appropriate one and that is why his final text contained half of the words that he totally produced during the process of formulating. He repeatedly reread the formulated texts which consequently resulted in inserting some modifications to the written texts. Comparing to the other participants, mW₂ also had a wide spectrum of editing and revising variations ranging from insertion, deletion, substitution and transposition. However, he made more of his reformulating amendments during medial reformulations.

In sum, this participant was monitored to have a quite different performance pertaining to his personal inclination towards writing and the particularity of his writing style. Personality-wise, he has been an auditory/musical writer

who made a request for listening to his favorite music while taking the composition task. His choice of vocabulary was slightly rhyme-oriented rooted in his boundless enthusiasm for literature and more specifically for poetry. He wrote his abstract semichaotically at first and edited the final version of it through transposition.

Statistical Findings

To compare the covert processes of editing and revision among different academic text genres a chi-square (crosstabs) was run. As a reminder, to address the second research question, a null-hypothesis was formulated by the researchers i.e. *there is no significant difference between the covert processes of editing and revision in writing different academic text genres.*

Table 7 below presents three pieces of information, that is, frequency, percentage and standardized residual (Std. Residual). The former two are descriptive indices based on which no statistical inferences can be reached; however, the latter is a standardized index based on which the frequencies of vertical cells can be compared for detecting significant differences. Any Std. Residual higher than +/- 1.96 denotes that the frequency was significantly beyond expectation (+) or significantly lower than expectation (-).

Based on the results it can be stated that the process of editing was more used in abstracts (28.2 %) compared with the process of revision (19.8 %) although none of the Std. Residual values were beyond the ranges of +/- 1.96. Thus, it can be claimed that there was not any significant difference between the processes of

editing and revision in writing the abstract. The process of revision, however, was significantly used beyond what was expected in conclusions (33.9 %, Std. Residual = 2.1 > 1.96), while the process of editing was not significantly beyond +/- 1.96, i.e. (21.2 %, Std. Residual = -1.2 < -1.96) and thus was less used.

Table 7
Frequencies, Percentages and Std. Residuals; Types of Processes by Genres

		Genres				Total	
		Abstract	Conclusion	Data Commentary	Cover Letter		
Types	Revision	N	24	41	22	34	121
		%	19.8%	33.9%	18.2%	28.1%	100.0%
		Std. Residual	-1.3	2.1	-1.2	.5	
	Editing	N	97	73	88	86	344
		%	28.2%	21.2%	25.6%	25.0%	100.0%
		Std. Residual	.8	-1.2	.7	-.3	
Total	N	121	114	110	120	465	
	%	26.0%	24.5%	23.7%	25.8%	100.0%	

The process of editing was more used in data commentary (25.6 %) compared with the process of revision (18.2 %) although none of the Std. Residual values were beyond the ranges of +/- 1.96. Thus, it can be claimed that there was not any significant difference between the processes of editing and revision in writing a data commentary.

The process of revision was more used in cover letter (28.1 %) compared with the process of editing (25 %) although none of the Std. Residual values were beyond the ranges of +/- 1.96. Thus, it can be claimed that there was not any significant difference between the processes of editing and revision in writing a cover letter.

Table 8
Chi-Square Tests; Types of Processes by Genres

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.666 ^a	3	.014
Likelihood Ratio	10.532	3	.015
Linear-by-Linear Association	.356	1	.551
N of Valid Cases	465		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 28.62.

The results of chi-square ($\chi^2(3) = 10.66$, $p = .014$, $r = .151$ representing a weak effect size) indicated that there were significant but weak differences between the processes of re

vision and editing. Thus, the null hypothesis was rejected and the results should be interpreted cautiously due to the weak effect size value of 0.151.

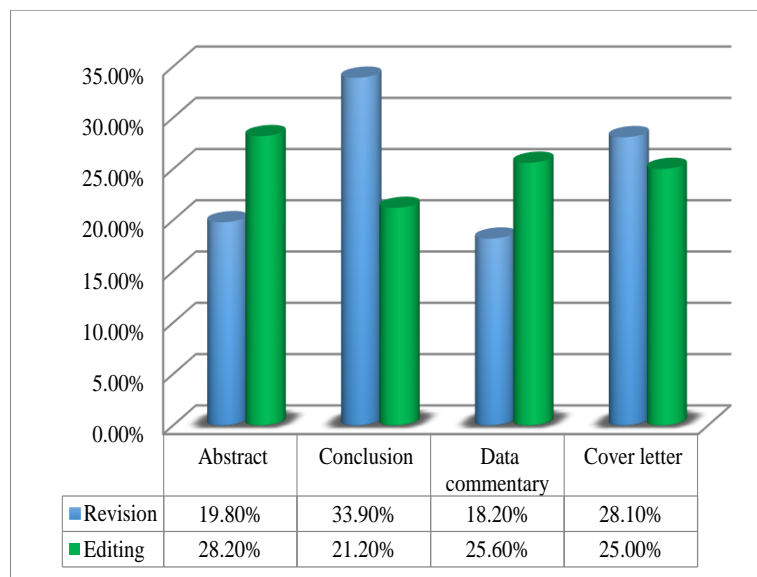


Figure 6 Percentages; types of processes divided by genres

CONCLUSION

The grounded theory emerging from the analysis of the collected data explains that writing is a cognitive activity, which involves different processes reiteratively transpired during the composition. In this regard, the researchers drew a comparison between the pendulum effect and the motions of processes recursively involved in writing. The theory can be situated within the boundary of composing-as-a-cognitive-process, one of the four metaphors proposed by McCarthy (2007) concerning the process theory of composition.

Through the employment of think-aloud protocol as the major data elicitation technique, the researchers revisited the cognitive process theory of writing proposed by Flower and Hayes (1981) for first language composition. However, the researchers placed emphasis on one of the processes involved in writing, namely, reformulating and analyzed it in details. By selecting academic text genres, the researchers added social dimension to the findings of the research indicating that attending the genre conventions and considering readerships the writers might encounter some new obstacles that need to be surmounted. This is to some extent analogous to what Flower and Hayes referred to as the writer's

longterm memory which contains knowledge of topic, audience, and writing plans.

Based upon the time of its occurrence, reformulating process can be classified into three types, that is, initial, medial, and terminal reformulations which were relatively in accord with Allal, et al. (2004) division of revision: pre-textual, on-line, and deferred. Moreover, the researchers believed that revision and editing could be two subprocesses of reformulating process depending on the target writers intend to meet. Revision and editing fall into different categories. In line with this, Allal, et. al. (2004) discriminated between *editing* which incurs no meaning alterations and is executed to correct errors and inaccuracies and *rewriting* which entails alteration to the meaning and involves transformation, addition and deletion.

Overall, the findings of this research strengthen the idea that writing is a sociocognitive activity in which different processes recursively transpire. Moreover, it indicates that writers need to be equipped with the knowledge of the language as well as the context in order to be able to properly compose in each text genre. In general, the implications of the research could be divided into theoretical and pedagogical implications. As to theoretical

implications, this study suggests that formulating process which has been one of the main processes involved in writing could comprise of two subprocesses of conceptualization and construction. Moreover, the researchers considered the process of reformulating as the stage at which writers bring modifications to the text through either editing or revision. In other words, the researchers determined that reformulating is a fresh formulating process whereby writers undergo reconceptualization and reconstruction processes. In terms of pedagogical implications, the findings of the present research highlight the fact that in writing courses, teachers need to place emphasis on the significance of editing and revision processes in academic writing.

Further studies need to be carried out in order to scrutinize in depth the other covert processes that were involved in writing. More research is required to detect the peculiarities and idiosyncrasies of each writer during the composing processes. It would be interesting to compare the composing processes among novice, professional, as well as creative writers. Further investigations are needed to consider the other academic text genres as well as the text types (e.g. narrative, argumentative). A further study investigating covert processes involved in writing literary text genres would be very interesting. All the above-mentioned studies could be conducted using other writing observation techniques, i.e., versioning and stimulated recall. Moreover, keystroke logging program (Inputlog) has other types of analysis such as pause analysis and linguistic analysis, which could help researchers study writing processes further.

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Bio data

Dr Alireza Ameri is a two-decade teacher and researcher of English language working with undergraduates, graduates and post-graduates of art and English studies. Dr. Alireza Ameri has been experimenting with this language in the capacity of the faculty member, head of department, vice-dean of research, supervisor, advisor, examiner of a host of creatively themed interdisciplinary qualitative theses and dissertations at IAU, South Tehran Branch, and paper and workshop presenter at national and international academia. He is an idea developer in the sense that he has invariably thought of merging art, education politics, ethics, mythology, chaos, and language into novel conglomerations. He is also a published poet, translator, interpreter, lexicographer, art enthusiast, creative English Language Teaching (ELT) educator, applied linguist, opinion developer, interdisciplinary thinker, word coiner and tag liner and has touched upon a kaleidoscope of issues from hegemony to edutainment.

Email: a_ameri@azad.ac.ir

Zahra Pourniksefat graduated with a master degree in the field of Teaching English as a Foreign Language (TEFL) from the Islamic Azad University-Science and Research Branch Tehran, Iran. She also received a bachelor degree in the field of English Language Translation studies from the Islamic Azad University South Tehran Branch, Iran. She has been a TESOL member and conducted different research studies on learner and teacher autonomy, intercultural rhetoric and EAP, and contrastive analysis of machine translation output. Her research interests encompass second language writing, teaching and assessment, innovative approaches to conducting qualitative research, and discourse analysis.

Email: z.pourniksefat@srbiau.ac.ir