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## AUTHOR

**Anita Fatimatul Laeli 1 , Slam , Syafi'ul Anam 3**

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# EFL Pre-service Teachers' Open Internet Reading Processing and Its Implication for Teaching: A Guided Think-Aloud Study

Anita Fatimatul Laeli<sup>1</sup>, Slamet Setiawan<sup>2\*</sup>, Syafi'ul Anam<sup>3</sup>

<sup>1</sup> State University of Surabaya, Lidah Unesa Campus Road, Surabaya, IDN-60213 Indonesia, anita.19028@mhs.unesa.ac.id

<sup>2\*</sup> State University of Surabaya, Lidah Unesa Campus Road, Surabaya, IDN-60213 Indonesia, slametsetiawan@unesa.ac.id

<sup>3</sup> State University of Surabaya, Lidah Unesa Campus Road, Surabaya, IDN-60213 Indonesia, syafiul.anam@unesa.ac.id

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**Annotation.** The mixed-method study explores EFL pre-service teachers' cognitive processes during open Internet reading in the teaching practice. The data were analyzed through t-test and think-aloud protocol (TAP). The quantitative findings indicated that the participants in the TAP group performed better in reading performance than the non-TAP's. The qualitative results indicated that the TAP group applied their reading processing through problem identification, selection, and elaboration.

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**Keywords:** *pre-service teachers, printed text, digital text, cognitive processing, guided think-aloud, open Internet reading.*

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## Introduction

The rapid development of technology has revolutionized traditional printed reading into online/digital reading and Internet reading platforms. These evolutions bring consequences for researchers and educators, who need to find relevant strategies to understand and explain learners' cognitive and metacognitive processes during their interactions with the various reading environments (printed, online/digital, and Internet readings). For example, to understand learners' hidden cognition, numerous experts have agreed that a 'think-aloud protocol' (TAP) could be applied to explain their hidden cognition by verbalizing their thinking process during reading experiences. As a result, the 'think-aloud' approach has been widely applied in various reading activities involving printed,

online/digital, and closed Internet reading environments (Ahmadian & Pasand, 2017; Mesgar & Tafazoli, 2018; Shang, 2018).

Because of the unprecedented acceptance of ‘think-aloud protocols’ within various reading environments – printed reading (Ghavamnia et al., 2013; Karlsson et al., 2018; Schellings & Broekkamp, 2011; Tolhah & Sugirin, 2021; Yayli, 2010), online/digital reading (Altay & Altay, 2017; Chen, 2015; Coiro & Dobler, 2007; Gilbert, 2017; Li, 2020; Rogne & Gamlem, 2017), and closed Internet reading spaces (Anmarkrud et al., 2014; Cho, 2014; Goldman et al., 2012; Kendeou et al., 2011; Salmerón et al., 2017; Yeari & Lev, 2020) – researchers have endeavoured to integrate think-aloud strategies to uncover research participants’ reading cognitive strategies during printed, online/digital, and closed Internet reading sessions. Various aspects of online/digital and Internet reading activities have widely elaborated on the use of think-aloud approaches to explain participants’ verbal cognitive processes during reading activities, such as middle school literacy programs (Fisher et al., 2011), Internet reading processing patterns, strategies for less and more able readers (Anmarkrud et al., 2014; Cho, 2014; Goldman et al., 2012; Yeari & Lev, 2020), scanning and deep processing (Rogne & Gamlem, 2017; Salmerón et al., 2017), online/digital reading problems (Hinostrroza et al., 2018), and efficacy (Ahmadian & Pasand, 2017).

However, the author found several methodological flaws in a systematic review that used think-aloud protocol in printed reading, online/digital, and closed Internet reading environments. First, printed, digital, and closed Internet reading participants are passive readers because they do not construct their comprehension. Second, the reading teachers commonly assigned their students to find and locate specific information from pre-prepared passages (such as printed texts, digital applications, and hyperlink reading) without coaching or guiding the learners before the intervention. This lack of guidance potentially causes biased interpretation and skews the results of the study. In addition, previously published articles have mostly applied the traditional cognitive model for printed reading comprehension, which differs from open Internet reading that offers more challenging cognitive tasks since the students actively search, locate, select, comprehend, and construct information from open Internet access. Therefore, the present study examined the effectiveness of guided think-aloud protocols using Fisher et al. (2011)’s think-aloud coaching models and cognitive processes within an open Internet reading environment using more detailed theoretical frameworks of Internet reading strategies (Argelagos & Pifarré, 2012; Dinet et al., 2012; Hinostrroza et al., 2018). Specifically, it compared EFL pre-service teachers’ Internet reading processing, both with a think-aloud approach and without the intervention treatment, during open Internet reading activities. Finally, the participants’ open Internet reading strategies and teaching implications from the two cohorts were elaborated. Based on the abovementioned research gaps, this study aims to investigate EFL pre-service teachers’ cognitive processing during open Internet reading using guided and unguided think-aloud protocols.

## Literature Review

### *Previous Studies of the Think-Aloud Protocol in Reading Comprehension*

A literature review of previous studies from 2010 to 2021 in selected peer-reviewed journals examined the connection between think-aloud protocol under printed, digital, and closed Internet reading. These previous works have revealed three essential issues: (a) closed reading strategies with a hyperlink; (b) ready-served digital reading applications; and (c) no detailed theoretical frameworks explaining the cognitive processes (this aspect is elaborated in the theoretical framework section). The first part of this literature review dealt with: (a) close-ended/limited Internet reading activities with a hyperlink, webpage, and (b) ready-served online/digital reading during the implementation of the think-aloud protocol in the Internet, webpage, online/digital reading comprehension activities from various education areas, including four studies in English as a second and foreign language (ESL/EFL) settings. Of the 14 studies, seven reported their think-aloud protocol activities using closed Internet/hyperlink reading environments (e.g. Anmarkrud et al., 2014; Cho, 2014; Goldman et al., 2012; Kendeou et al., 2011; Salmerón et al., 2017; Yeari & Lev, 2020) except one study by Fisher et al. (2011), digital reading materials using different reading applications (e.g. Altay & Altay, 2017; Argelagos & Pifarré, 2012; Chen, 2015; Coiro & Dobler, 2007; Dinet et al., 2012; Gilbert, 2017; Hinostrroza et al., 2018; Li, 2020; Rogne & Gamlem, 2017; Tarchi, 2021).

Within the closed Internet space, a study by Salmerón et al. (2017), for example, investigated middle school participants' abilities for scanning and profound processing of information using Wikipedia. In this research, the 21 participants were assigned to access a document about the French Revolution from the school repository. Similarly, Cho (2014) investigated seven competent high school readers' Internet reading complexities using the hyperlink model. The study participants responded to critical questioning tasks and read sources through hyperlink selection from the Internet. Finally, a recent study by Yeari and Lev (2020) scrutinized poor readers' strategies to identify central and peripheral processes during and after fast Internet expository reading. Twenty-seven native Hebrew participants were required to read three expository texts: breastfeeding, the Coca plant, and the Prophetess from Delphi. Then, they were asked to recall the centrality level of text ideas and rate peripheral ideas, respectively. Of the 14 studies, six studies were conducted in online/digital reading environments. Chen (2015), for example, surveyed 94 Taiwanese EFL students ranging between high and low proficiency levels. First, the surveyed participants were asked to observe tables, figures, and pictures. After the online/digital reading activities, they completed the OSORS (online reading strategies) questionnaire to determine the differences in perceived strategies between low- and high-proficiency students. Similarly, Li (2020) surveyed 272 tertiary EFL students from five universities across China with the same research objective and using the same OSORS

instrument. Again, the results indicated that the participants barely applied their traditional reading strategies to the online reading environments.

The second part discussed non-guided think-aloud protocol practices during and after the digital and closed Internet reading activities. Of the 14 studies, 13 implemented a non-guided think-aloud protocol. Only one study by Fisher et al. (2011) included the coaching of middle school teachers from different courses with think-aloud protocol, using online reading sources as part of their school literacy program, which involved less comprehensive reading activities since the online/digital reading tasks and sources are readily available on the school website. The researcher commonly asked the students to verbalize their cognitive and metacognitive processes during and after online/digital reading activities. Previous studies have described the stages of the comprehension process, but participants' specific cognitive activities during open Internet readings were not elaborated on.

The examples commonly apply think-aloud procedures within the closed/limited number of sources and hyperlinks. The designs of those studies allowed the research participants to verbalize their limited set of strategic actions because of the narrowed Internet access provided by the researchers through hyperlinks and uploaded reading questions, materials, and sources. Such designs differ from an open-ended Internet reading space, which is more dynamic and involves complex situations such as: defining information, using keywords, scanning and evaluating webpages, processing and answering Internet reading tasks (Argelagos & Pifarré, 2012; Dinet et al., 2012; Hinostroza et al., 2018; Timpe-Laughlin et al., 2021; Yeari & Lantin, 2021).

### ***Guided Think-Aloud Protocols in Internet Reading: Theoretical Framework***

The strategies employed by students for Internet reading have evolved into two different theoretical frameworks. These are: a) Kintsch's (1998) theory of comprehension and b) Afflerbach and Cho's (2009) theory of constructively responsive reading, which are commonly applied to elaborate on the dynamics and complexity of reading strategies within Internet settings. These frameworks have provided insightful contributions to the body of knowledge, especially regarding Internet reading strategies. However, they are not without limitations, such as their inability to portray the detailed strategy categories during open-ended Internet reading activities. Previous research has not distinguished between four reading types: printed, online/digital, closed Internet, and open Internet reading strategies. The two theories were applied to printed, digital, and closed Internet reading activities with less consideration because printed, digital, closed Internet, and open Internet reading require different cognitive processes. In addition, previous studies have mainly elaborated on reading strategies applied to limited sources and hyperlinks within closed Internet reading environments without a guided think-aloud protocol. The unguided think-aloud protocol might cause biased interpretations and findings

because every reader has different strategies. In this study, the researcher combined several Internet reading frameworks from different experts to understand the information problem, use a search engine and find keywords, scan, evaluate, and select information, and integrate the information to construct an answer during Internet reading aloud activities (Argelagos & Pifarré, 2012; Dinet et al., 2012; Hinostroza et al., 2018; Yeari & Lantin, 2021). Those five processes were then coached to participants before the interventions were conducted. This process is then called a guided think-aloud protocol. During the implementation of this guided think-aloud, the researcher adopted Fisher et al.'s (2011) think-aloud coaching model as the theoretical framework of this study.

Two previous studies by Anmarkrud et al. (2014) and Goldman et al. (2012) were ground-breaking in terms of understanding participants' reading strategies in close-ended Internet settings (with a limited number of hyperlinks and sources), which are less complicated than open-ended Internet reading spaces (with an unlimited number of hyperlinks and sources). The above two studies helped describe limited Internet reading strategies because of the limited access and sources. While practical and theoretical contributions from various reading strategies – both printed and online/digital settings – have been acknowledged, it suggests the need for scrutinizing reading strategies within a more dynamic and complex set of strategic actions in an open-ended Internet space. The present study explores EFL pre-service teachers' strategic reading acts in Internet settings. It analyzes their verbal reports using five strategy processes: understanding the information problem, using a search engine and finding keywords, scanning, evaluating and selecting information, and integrating the information to formulate an answer (Argelagos & Pifarré, 2012; Dinet et al., 2012; Hinostroza et al., 2018; Tarchi, 2021; Yeari & Lavie, 2021). Specifically, the research questions are elaborated below:

1. Will there be any significant difference in students' open Internet reading comprehension ability after implementing guided think-aloud protocol compared to without guided think-aloud protocol?
2. How do EFL pre-service teachers define, scan, evaluate, and select relevant Internet reading sources?
3. How do EFL pre-service teachers process and integrate their open Internet reading sources to formulate the answer?

## Methods

### *Design*

The study employed an exploratory or mixed-methods design, combining experimental research and in-depth interview designs as part of a teaching practicum course (micro-teaching laboratory) in which each research participant was asked to solve information problems using the open Internet space. During four Internet reading sessions over eight weeks, the author asked students to answer two to four information problems in 16 open Internet reading assignments. An experimental study involving guided and non-guided think-aloud protocols during open Internet reading activities was administered to the intervention and control groups to assess the impact of guided TAP on students' reading comprehension. Subsequently, in-depth interviews and observations were administered to elicit students' detailed verbal cognitive processes during open Internet reading activities.

### *Participants and Context*

This study employed an intensity sampling procedure, introduced by Patton (1990), to select a small number of study participants who could provide rich and in-depth information on Internet reading strategies. Although this study depends on a fine-grained analysis of the research participants' think-aloud or verbally reported data, the study participants were required to have a high reading and verbal proficiency (Afflerbach et al., 2008; Cho, 2014). High-proficiency readers may engage in adaptable reading strategies to process and orient themselves in a complex Internet reading structure. They are also more likely to reflect introspectively on what is occurring in their minds while reading in an Internet setting (Cho, 2014; Coiro & Dobler, 2007). Based on those conceptions, the study participants selected were pre-service English teachers from the English Education Department of a prestigious private university in Jember, Indonesia. This department prepares students to become English teachers. They were tightly selected based on their advanced reading scores (30%), paper-based reading comprehension TOEFL scores (40%), and speaking scores (30%). Students who scored between 81 and 97 out of 100 were selected, but students who scored below this were excluded from the study. Eight female and eight male study participants, with an average age of 23.50, were selected out of 62 students. During the teaching practicum, these seventh-semester students participated in this research. Then, these selected participants were assigned to two different groups. The first set belonged to a guided think-aloud protocol (GTAP) group and the second to a non-guided think-aloud protocol group (TAP).

## *Instruments and Procedures*

During four Internet reading sessions over a period of four weeks, the author asked the participants to complete four online reading tasks, comprising of 16 questions (four questions for each task), using the Internet. The online reading assignment was designed and piloted with four different EFL students. The four Internet reading topics were adopted from Hinostroza et al. (2018): life expectancy, general arts, cinema, and healthy foods. In this study, the participants were required to: (a) briefly define the method applied in various countries to estimate the population's life expectancy; (b) describe rewards for talented writers, painters, and musicians equivalent to the Oscar awards for actors; (c) compare the painting styles of Picasso, Goya, Rembrandt, and Dalí; and (d) research healthy food that helps you remain awake and active. The questions were phrased in such a way as to require the participants to locate facts, search and interpret definitions or explanations, look for information to compare situations, and search for information to address the problems. The questions were presented to each participant in the same sequence, with a maximum duration of 80 minutes.

### *Phase 1: Pre-test*

Participants were given a standardized interactive global competence reading test (OECD, 2018). These 25-question items aimed to evaluate, formulate arguments, identify multiple perspectives, and explain issues. The test involved five different topics, namely rising sea levels (five items), a single story (four items), ethical clothing (four items), refugee Olympians (five items), and language policy (four items). This test was selected by considering the relevance between online reading objectives and online reading courses taught using a think-aloud protocol. The pre-test was given in a printed version. However, the author did not discuss the pre-test answers.

### *Phase 2: Guided think-aloud instructions*

The intervention group's (GTAP) participants were trained to think-aloud during their Internet reading session. This group was trained to complete a training task following Fisher et al. (2011). During the training, they learned how to figure out the information problem, use a search engine to find keywords, scan, evaluate, and select information, and integrate it to formulate an answer. The participants were also instructed to verbalize all of their thoughts during the Internet reading activity. The training took between 20 and 30 minutes. The entire session was audio-recorded. Conversely, the control group (TAP) did not receive this training. They were instructed to verbalize the whole Internet reading process freely.

### *Phase 3: Online reading topics and exercises*

The participants read several Internet reading sources. The topics were taken from Hinostroza et al. (2018), covering four different task types. This Internet reading focus was selected because those four topics contain different areas of knowledge to avoid the



possibility that the participants could know about all the topics. The topics and exercises also promoted participants' cognitive skills based on Bloom's taxonomy. The Internet reading materials require the participants to locate facts from figures or tables, compare, analyze, synthesize, and formulate a detailed answer, based on the results. This third phase was conducted over ten weeks. The specific Internet reading tasks were:

#### *Internet reading session 1: Life expectancy*

This Internet reading activity required the participants to: define the method used for calculating the age of people in different countries; describe at least three scientific factors causing an increase in life expectancy in Chile; find the difference in years between the countries with the highest and lowest life expectancy in South America; identify the main reason for this difference; identify the five countries that show the highest life expectancy; and explain the three main consequences.

#### *Internet reading session 2: Cinema*

In the second session, the participants were required to: identify and explain three actresses who worked in the last year; identify the plot of the film most nominated for an Oscar award; name the five films that have generated the highest profits since 2015; and explain the prizes, equivalent and of equal importance to the Oscar for actors, awarded to musicians, stage actors, painters, writers, and scientists.

#### *Internet reading session 3: General arts*

The third session required the participants to: locate three different artworks by Claude Monet and their prices on the market today; find the procedures for determining the value of new and old paintings; compare the painting styles of Picasso, Goya, Rembrandt, and Salvador Dalí using the same subject; and justify the highest-value painting in each style (Abstract, Pop, Realism, Surrealism, and Impressionism).

#### *Internet reading session 4: Drugs*

This session required the participants to: identify the active components of the drug Mentix and its side effects; find the action mechanism of Mentix in the central nervous system; identify food that keeps you awake and active; select three different foods, compare the mechanisms and the desired effect; and write recommendations based on physical and psychological factors determining whether or not we should use Mentix.

#### *Phase 4: Post-test*

The same interactive global competence reading test by OECD (2018) was administered to measure participants' reading progress after four months of the guided think-aloud procedure. The post-test was also given in a printed version. However, to avoid the washback effect of the pre-test, the author did not discuss the answers.

## Data analysis

An analysis of variance was applied to measure the impact of guided think-aloud protocols on participants' reading comprehension scores. A central tendency of the two different cohorts was then analyzed using a statistical test (Fisher et al., 2011). Meanwhile, the oral Internet reading data from the study participants were collected using the think-aloud approach (Gerjets et al., 2011; Hinostroza et al., 2018). This approach prompts participants to verbalize their cognitive processes during Internet reading and problem-solving tasks (Oh & Wildemuth, 2017). The author and her research team (co-authors) agreed to code the think-aloud protocols at 89%. Participants' responses from the two different groups during the think-aloud task were transcribed and analyzed based on the following five main categories: understanding the information problem; using a search engine and finding keywords; scanning, evaluating and selecting information; and integrating the information to formulate an answer (Argelagos & Pifarré, 2012; Dinet et al., 2012; Hinostroza et al., 2018). In addition, each coding scheme was developed using constant comparative approaches until two different coders agreed on a final set of coding categories. The first author coded participants' oral reports or summaries. Meanwhile, inter-rater reliability was checked by the second and third authors, who organized 33% of participants' transcribed oral summaries into those five categories (Rogne & Gamlem, 2017). Any disagreements between the two coders were resolved through discussion with the research team.

## Results

### *Differences in Students' Open Internet Reading Comprehension Abilities*

Before addressing the research's first question, normality and homogeneity tests were administered using a Shapiro-Wilk test, which is relevant in analyzing some samples with less than 50 research participants. Table 1 presents the statistical measure of normality groups between the intervention group using the guided think-aloud protocol and the control group using the unguided think-aloud protocol in the same open Internet reading environments. The results reveal that the data from the two cohorts were normally distributed, since the significance values were .286 and .179, above the alpha value of .05.

**Table 1**

#### *Normality Test Results*

Group	Shapiro-Wilk		
	Statistics	Df	Sig.
Intervention group (GTAP)	.634	8	.213
Control group (TAP)	.648	8	.169

\*significant at  $p < .05$ .

Table 1 illustrates the results of the normality tests. The statistical tests indicate that the two groups were normally distributed since the significant values were greater than the alpha values. Therefore, further homogeneity tests are suggested.

**Table 2**  
*Homogeneity Test Results*

Levene's statistics	Shapiro-Wilk		
	Df1	Df2	Sig.
2.141	1	.92	.126

\*significant at  $p < .05$ .

Table 2 depicts the calculated results of the homogeneity tests for the two groups. The statistical tests indicate that the significance values of the two groups were greater than the alpha values (.213 and .169). Consequently, the homogeneity of the two cohorts has been attained.

During open-ended Internet readings, the intervention group with guided think-aloud protocol (GTAP) and the control group with non-guided think-aloud protocol (TAP) did not differ significantly on the administration of a standardized interactive global competence reading assessment (OECD, 2018). Furthermore, the intervention and control groups' average reading scores were 5.5 and 5.4, indicating that students in both groups did not differ (see Table 3).

**Table 3**  
*Group Comparisons on the Interactive Global Reading Assessment*

	M (SD)	F	<i>p</i>
<b>Pre-test</b>			
Intervention group (GTAP)	5.5 (1.07)		
Control group (TAP)	5.4 (1.13)	1.91	.167
<b>Post-test</b>			
Intervention group (GTAP)	6.4 (.93)		
Control group (TAP)	5.8 (1.41)	84.16	.001

However, compared to the post-test, the average reading score for the students whose TAP was guided had increased to 6.4, whereas that of the control group had only increased to 5.8. As illustrated in Table 3, these post-test results were statistically significant, and the effect size for the intervention was .440. These data suggest that conducting open online readings with guided think-aloud could improve students' comprehension. When students were provided with a model of open Internet reading comprehension, they appeared to

perform better on cognitive comprehension tasks. An analysis of the guided plans and online reading observations during guided TAP revealed many interesting trends.

### ***EFL Pre-Service Teachers Define, Scan, Evaluate, and Select Relevant Internet Reading Sources***

#### *Defining Internet reading problems and sources*

In the first think-aloud activities, the author identified three cognitive processes regarding participants' verbal themes of "defining the Internet reading sources". Firstly, participants' activities during problem interpretation were identified; secondly, utterances in which participants used their found keywords; and thirdly, utterances in which they used their found keywords to find the Internet reading sources.

In the first activity, the findings dealt with students' problem-solving interpretation strategies during understanding open Internet reading questions; the author identified three different categories:

The first category dealt with the participants' efforts to comprehend and identify the questions by reading the questions several times and extracting the essential aspects of the questions. The following excerpts represent students' efforts.

- S1 : [Student 1 reads the first question on life expectancy twice] "Define the method used for calculating the age of people in different countries". Okay, I will rely on the words 'method' and 'life expectancy in different countries'. These keywords are good for me to keep in my mind.

Before analyzing the essential aspects of the questions, the participants read the questions (life expectancy in Chile and South America) several times to strengthen their comprehension. After reading the questions several times, they then analyzed the essential aspects of the questions (method for calculating life expectancy in Chile and South America, highest and lowest life expectancy, the main reason, and consequences). They constructed their interpretation based on the essential aspects (a keyword or phrase) of their understanding. These essential keywords and phrases were not yet in fixed order. They used them to facilitate comprehension and identification.

The second category dealt with students' strategies to rephrase the questions into their own words, translate the unfamiliar words, and find synonymous words to enable their understanding. The following excerpts represent students' strategies.

- S2 : I am going to search for the meaning of "Surrealism" to justify the comparison among other styles. I did right-click to find the meaning and synonymous words to make me easy to understand. I also check this word on Google to find the meaning and examples.

The students tried to find the meaning of the unfamiliar word by using a synonymous word from a computer dictionary and Google search. After the synonyms and meanings had been found, they continued rephrasing the questions using their own words. Then, the comparisons among different art styles were interpreted into abstract, pop, realism, surrealism (culture development), and impressionism. Finally, they put the synonymous words using culture movement, which they had read on Wikipedia.

The third category dealt with students' strategies to construct their initial interpretation using their own words. Students' initial interpretations of the reading questions were formulated after they had understood the content and instruction. The excerpts below indicate their strategies.

- S3 : I do not know the types of painting styles, but I am familiar with the meaning of realism, abstract, and pop. I can understand the meaning of surrealism after consulting a Google search and trying to get the meaning. Afterward, I used my own words to identify the questions.

Students' initial interpretations were applied after understanding the specific content of the questions' instructions. They also associated the words "*abstract*" and "*realism*" with paintings to represent something unreal and real. This third strategy could not be separated from the first and second categories.

In the second activity, the findings dealt with students' strategies to use their found keywords/phrases to identify the reading questions. In this stage, the author identified one category.

- S4 : I am reading the questions on a drug called Mentix several times. After reading the instructions and questions five times, I decided to take the essential keywords, such as Mentix's working mechanism on the body and its side effect. I found it challenging to understand the word Mentix, but I could understand the essential keywords by connecting with the context. Later, I will use those two keywords as guidance for Internet browsing.

The excerpts explained the students' strategies as they sought to understand the content of the questions using keywords, after reading the questions many times. Since the word Mentix was unknown to them, they tended to use the surrounding words before and after Mentix to help them understand the instructions and questions.

In the third activity, the findings dealt with utterances in which the participants used their found keywords to find relevant Internet reading sources. In this stage, the students typed their keywords into the Google search to find and select relevant reading sources.

- S7 : [The student types in the Google search bar "Chile life expectancy" and "South America life expectancy". He also tries to modify synonymous keywords: life expectancy in Chile]. Then, I read all the Internet readings about Chile and decided to take one the most relevant, namely "Chile life expectancy 1950–2021".

An exciting finding emerged from this phase, wherein the students tried to modify their keywords while searching using the synonymous words “Chile life expectancy” and “Life expectancy in Chile”. Since Google displayed the same Internet reading sources then, the students decided to select the most relevant reading sources by scanning the content of the information.

### *Scanning, evaluating, and selecting Internet reading sources*

In the second think-aloud activity, the author identified one cognitive process regarding participants’ verbal themes: “scanning, evaluating, and selecting reading sources”. The participants scanned, evaluated, and selected their Internet reading information from Google at the same time. While scanning the relevant information through quick reading, they simultaneously evaluated and selected the information’s relevancy. The following excerpts illustrate the two coincidental processes between scanning and evaluating.

S6 : [The student reads considerable information regarding the Oscar-winning film actresses]. I move my cursor up and down to find relevant information regarding the most paid actresses in Oscar awards before 2015. Finally, I selected one of them after quick reading and found the title “List of Oscar-winning actresses since 2010 up to now”.

The excerpts illustrate how the students combined scanning, evaluating, and selecting strategies to find relevant reading sources before addressing the questions. For example, they moved their cursors up and down, opened the text after identifying the relevant information, and read, evaluated, and selected the contents based on scanning activities.

### *Pre-Service Teachers Process and Integrate Open Internet Reading Sources to Elaborate on the Answer*

The third research question discussed participants’ cognitive processes while reading the selected sources and participants’ strategies to elaborate on the answers.

### *Participants’ cognitive processes while they were reading the selected sources*

The author identified three categories associated with the first cognitive reading processes: copying and pasting the key questions, reflecting the critical questions on the Internet reading texts, and pasting the relevant answers. The excerpts are illustrated below.

S5 : [The student copied and pasted the question of five actresses who became Oscar winners before 2015]. I paste the question and reflect on the keyword questions in the reading text to find the possible answers. Then, I also copied the text and pasted it below the question. I do it to all parts.

Some students copied and pasted the questions to their Word document as their guide to finding the answers while they were reading the text. In so doing, they kept their keyword questions in their minds during the reading activities in order to reflect

on the text and find the answer. Once they had found the answer, they copied and pasted it below the questions in their Word document. In this phase, they produced their initial estimation for answering the questions.

### *Participants' strategy for elaborating on the answers*

This section deals with participants' verbal strategies for elaborating on the answers. In this part, the author identifies the other four categories of the elaboration process: arranging the structure, incorporating the answer into their ideas, rephrasing the copied and pasted initial answers, and revising the answers.

- S8 : [The student writes the introduction, problems, answers, conclusions, and references]. After I find the answer to the side effect of Mentix drugs, mechanisms, and types of healthy foods, I start writing my introduction with the definition of Mentix. Then, I put the questions and answers section and added the conclusion and references. Afterward, I continued to check each section, from the introduction to the reference sections. I rely much on logical flow, content, organization, and language.

After completing all parts, some students who had formatted their task structure rechecked their final work. They organized their work into different task structures as they provided the introduction, question, answer, conclusion, and references.

Alternatively, other students did not format the assignments into essay-like papers but merely formatted their task structure into questions, answers, and references. No introduction or conclusion was provided during this phase.

- S1 : [The student copied and pasted all questions into the Word document. The student mentions the method to estimate life expectancy, reasons for high life expectancy in Chile, five countries in South America, and their consequences]. I reflect on the four key questions during the reading and then copy and paste the possible answer before rechecking the content and language. I answered the questions based on the instructions.

Uniquely, some students applied different strategies to answer the questions. They did not format the structure into an introduction, questions, problems, conclusion, or references. Moreover, the open questions did not require the students to do so. Instead, they rechecked the answers, including content and language issues, at the end of the session.

## **Discussion**

The findings presented in the previous section provide a rich explanation of the kinds of cognitive activities the participants (pre-service teachers) employed while solving open Internet reading problems using guided think-aloud protocols. Concerning the first research question of whether there are any significant differences in students' reading

comprehension ability after implementing a guided think-aloud protocol, the post-test results suggest that teachers conducting open Internet readings with a guided think-aloud strategy can improve students' reading comprehension abilities. When students learned with a structured think-aloud model (from defining essential keywords to elaborating on the answers), their reading comprehension increased. In terms of improving their reading comprehension ability, this finding is commensurate with a previous study involving middle school in-service teachers' comprehension ability during printed reading experiences (Fisher et al., 2011). Other studies comparing digital/online reading using unguided think-aloud protocols and printed reading activities have reported similar results (Altay & Altay, 2017; Gilbert, 2017; Li, 2020; Rogne & Gamlem, 2017). Therefore, the findings of this study contribute to the body of knowledge (open Internet reading and guided think-aloud protocols).

Furthermore, this study revealed similar results from closed Internet reading strategies (Anmarkrud et al., 2014; Goldman et al., 2012). The current study employs online reading experiences, which involve a more complex cognitive process than printed and closed reading activities. Therefore, the novel finding of this study is derived from the perspective of the guided think-aloud strategy and its involved Internet reading experiences. In comparison, previous studies dealing with open Internet reading activities did not apply guided think-aloud activities (Hinostroza et al., 2018). The guided think-aloud allowed the students to verbalize their question identification, as well as their scanning, evaluation, selection, processing, integration, and elaboration on the answers. Internet reading with this guidance could direct the students' cognitive processes during open Internet reading experiences. These findings imply that during open Internet reading, the teacher should be aware of this cognitive process during their teaching of reading. Awareness of how to conduct a guided think-aloud activity can be helpful for teachers who want to apply this strategy.

The second research question asked how students define, evaluate, and select relevant reading sources from the open Internet before answering the reading questions. During the phase of defining the reading questions, the finding reported sequential strategies, namely: a) the students read the questions several times and took the essential keywords from the questions; b) the students rephrased the essential keywords from the questions using synonyms and translation if they found unfamiliar words; and c) the students constructed their initial interpretation and used the rephrased questions to find relevant reading sources. These cognitive processes were different from those found in previous studies. This study reported meaning simplification through the translation process and the use of synonyms before finding relevant reading sources to address the questions. Arifani et al. (2021) found that EFL learners applied a translation strategy using PISA reading comprehension within different printed reading contexts. Therefore, the students applied a more complicated cognitive process during open Internet reading activities under the guided think-aloud protocol. Meanwhile, two previous studies have indicated



the absence of stages of translation and word simplification, which were not reported in either study (Fisher et al., 2011; Hinostroza et al., 2018).

Another exciting result as a part of problem identification is that some students simultaneously evaluate and select their Internet reading sources through scanning activities. This demonstrates the use of different cognitive processes from those reported in previous studies. Prior research has reported that the use of scanning strategies, while the students read the online reading, was made after finding the texts. Within closed Internet access with hyperlinks and digital reading, the students did not find it necessary to scan or evaluate the reading contents (Anmarkrud et al., 2014; Goldman et al., 2012; Rogne & Gamlem, 2017; Salmerón et al., 2017; Yeari & Lev, 2020). Instead, they could directly read the questions, scan the relevant information, and match the answers to the questions. Consequently, these strategies add to the open Internet reading strategies, whereby the students are required to read the question, find relevant reading sources, and address the questions afterwards.

Regarding the third question of how the study participants process and integrate Internet reading sources to address the questions and elaborate on the answers, the findings showed that the students used a 'copy and paste' strategy on the keywords they found. While the students were reading the selected online texts, they copied and pasted their previous keyword questions into the Google search. They also reflected those critical questions in their reading text through scanning. Then, they copied the predicted answers from the reading text and pasted them into their Word document under the questions they had written previously. The students decided to copy and paste this because they wanted to collect relevant information before they decided on their final answers. The students commonly modified their answers at the end after all of the relevant information had been obtained. These strategies do not align with the results from two previous studies (Hinostroza et al., 2018; Rogne & Gamlem, 2017; Salmerón et al., 2017). Hinostroza et al. (2018) found that Psychology Department students applied more structured strategies during open Internet reading than shown in the present findings. Most study participants drafted their answers in Word documents before they searched their reading sources using specific keywords. Before the students copied and pasted the words from the text, they first compared the contents of the texts to different websites to confirm the quality of the information (Hinostroza et al., 2018; Van Deursen & Van Dijk, 2014). The finding of this study contradicts the previous research, as most of the students in this study did not draft their answers or compare the quality of information from different websites. Furthermore, in contrast to the previous research, the students did not compare information from different reading websites while answering open Internet reading questions (Hinostroza et al., 2018).

## Conclusions

The data from this study indicate that the modeling of thought processes using guided think-aloud protocols increases students' reading comprehension and awareness of cognitive reading strategies within complex open Internet environments. Beyond the acknowledgment of the practical impact that the coaching of students through think-aloud strategies has on their reading comprehension, this research adds to the growing body of literature on guided think-aloud protocol as an effective strategy for students or pre-service teachers to understand the verbal cognitive processes involved in open Internet reading before, they become teachers in the future. Understanding students' verbalized cognitive processes – involving problem identification, Internet reading source selection, and answer elaboration – during open Internet reading can be fruitful in helping students to develop deeper learning and complicated reading strategies as well as enhancing students' self-regulated reading skills within open Internet reading environments. Further research could aim to address and develop students' self-assessment skills during Internet reading activities. The key implication of this study is the need for pre-service teachers to be trained in the use of open Internet reading strategies, which differ greatly from printed and closed Internet reading with hyperlinks. Compared to previous studies, this research offers a more comprehensive insight into the cognitive processes used during open Internet reading activities. Training pre-service teachers in the use of guided think-aloud protocols during open Internet reading activities would also provide good experience for them in encountering future challenges in teaching reading within the Internet environment.

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## Būsimųjų anglų kalbos mokytojų skaitymo Internetė procesai ir jų reikšmė mokymui: garsinio mąstymo tyrimas

Anita Fatimatul Laeli<sup>1</sup>, Slamet Setiawan<sup>2</sup>, Syafi'ul Anam<sup>3</sup>

<sup>1</sup> Surabajos valstybinis universitetas, Lidah Unesa miestelio kelias, Surabaya, IDN60213 Indonezija, anita.19028@mhs.unesa.ac.id

<sup>2</sup> Surabajos valstybinis universitetas, Lidah Unesa miestelio kelias, Surabaya, IDN-60213 Indonezija, slametsetiawan@unesa.ac.id

<sup>3</sup> Surabajos valstybinis universitetas, Lidah Unesa miestelio kelias, Surabaya, IDN- 60213 Indonezija, syaful.anam@unesa.ac.id

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### Santrauka

Daugelyje ankstesnių tyrimų kognityviniai skaitymo procesai buvo nagrinėjami iš besimokančiųjų anglų kalbos perspektyvos, atliekant tradicinę skaitymo veiklą, o šiuo tyrimu

buvo siekiama ištirti būsimųjų anglų kalbos mokytojų kognityvinius procesus, vykstančius atviro skaitymo Internetu metu vykdant pedagoginę praktiką. Atliekant tyrimą buvo taikomi mišrūs metodai – eksperimentinis dizainas ir interviu. Kiekybiniai duomenys buvo vertinami naudojant t-testą, o kokybiniai duomenys buvo analizuojami naudojant garsinio mąstymo metodą. Kiekybiniai rezultatai parodė, kad grupės dalyviai, kuriems buvo taikytas garsinio mąstymo metodas, skaitė geriau nei grupės dalyviai, kuriems šis metodas nebuvo taikomas. Kokybiniai rezultatai parodė, kad grupės dalyvių, kuriems buvo taikomas garsinio mąstymo metodas, išsamios žodinės pažinimo strategijos, susijusios su problemos identifikavimu, Internetinių skaitymo šaltinių pasirinkimu ir atsakymo detalizavimu, buvo taikomos konkrečių išsamių strategijų atviro Internetinio skaitymo metu. Tyrimo išvadose rekomenduojama, kad labai svarbu ugdyti būsimųjų anglų kalbos mokytojų gebėjimus suprasti ir taikyti mokymosi strategijas, naudojantis atviro Interneto skaitymo platformomis pedagoginės praktikos metu, kad, pradėdami mokyti realiose situacijose, būsimieji anglų kalbos mokytojai turėtų tam pasirengimą.

Atsižvelgiant į tyrimo trūkumus, ypač į mažą eksperimento imtį ir garsinio mąstymo įgyvendinimą, rekomenduojama, kad tolimesni tyrėjai spręstų šiuos klausimus, naudodami didesnę imtį, ir kad išspręstų dar neatsakytus klausimus.

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**Esminiai žodžiai:** *būsimieji mokytojai, spausdintas tekstas, skaitmeninis tekstas, kognityvinis apdorojimas, garsinis mąstymas, atviras skaitymas Internetu.*

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