



# European Journal of Educational Research

Volume 9, Issue 2, 629 - 638.

ISSN: 2165-8714

<http://www.eu-jer.com/>

## What I know Best: Assessing Indonesian Student's Structural Knowledge through Student-Generated Topics

Rohmani Nur Indah\*

Universitas Islam Negeri Maulana Malik  
Ibrahim Malang, INDONESIA

Galuh Nur Rohmah

Universitas Islam Negeri Maulana Malik  
Ibrahim Malang, INDONESIA

Muzakki Afifuddin

Universitas Negeri Malang, INDONESIA

*Received: January 9, 2020 • Revised: February 19, 2020 • Accepted: March 27, 2020*

**Abstract:** Developing Indonesian English as a foreign language (EFL) students' structural knowledge presents a number of complexities especially in the bilingual context. This study aimed to determine how the structural knowledge patterns of Indonesian EFL students is, and it specifically explored various aspects that make structural knowledge representation difficult. The research also aimed to formulate an accommodative assessment model for the development of students' structural knowledge. Using a case study design, this study involved 120 English literature students (N=120) taking the Psycholinguistics class at one of the tertiary institutions in Malang, Indonesia. The research instruments included essay tests and questionnaires. The research findings showed that students in bilingual contexts have certain diversity and patterns in their structural knowledge. Second, students' structural knowledge could be influenced by a number of aspects such as topic mastery and the flow of thought. Furthermore, students' structural knowledge can be accommodated in an adequate evaluation model that measures structural knowledge and critical thinking skills. Further research in the area of content and language assessment will complete the study of the significance of structural knowledge in a bilingual context.

**Keywords:** *Assessment model, the flow of thought, student-generated topic, structural knowledge, topic mastery.*

**To cite this article:** Indah, R. N., Rohmah, G. N., & Afifuddin, M. (2020). What I know best: assessing Indonesian student's structural knowledge through student-generated topic. *European Journal of Educational Research*, 9(2), 629-638. <https://doi.org/10.12973/eu-jer.9.2.629>

### Introduction

Higher education institutions in Indonesia come across the demands to produce graduates with high research productivity, but this target often misses because it requires mastery of students' structural knowledge. Ideally, the ability to make scientific work will also increase with adequate structural knowledge. This is because students can assimilate various information obtained to become structural knowledge. So far, the achievement of students' structural knowledge encounters a number of difficulties surrounding the flow of ideas, self-regulation strategies, conceptual understanding, and vocabulary mastery (Indah, 2016; Lawson et al., 2019; Gonzalez-Fernandez & Schmitt, 2019).

In classes that teach content knowledge using foreign languages, students seem difficult to re-explain the concepts they understand (Indah, 2016). This is also more or less influenced by how students do self-regulation in their learning program (Lawson et al., 2019; Uz & Uzun, 2018). Students are not always able to express what they understand in adequate vocabulary knowledge (Gonzalez-Fernandez & Schmitt, 2019). Developing structural knowledge seems to have its specific complexity. Therefore, in-depth research is still needed to understand the structural pattern of structural knowledge, especially in English as a foreign language (EFL) context of learning.

Experts have been exploring the complexity of establishing the construct of structural knowledge. Structural knowledge is considered as a construction thought that is stored in the students' long-term memory equipped with meaningful and continuous relationships between concepts (Jonassen et al., 2013; Klock et al., 2019). The experts have also linked structural knowledge to other aspects such as vocabulary variations that represent the students' understanding of the concepts, motivations, and interests (Kim, 2019; Sorge et al., 2019). However, insufficient attention has been paid to how the construct of structural knowledge is clearly evaluated through an appropriate assessment which accommodates students' ability to elaborate their structural knowledge in the context of foreign language learning. In addition, the previous findings have only explained structural knowledge in a monolingual context

\* **Corresponding author:**

Rohmani Nur Indah, Jalan Ambarawa 19 Malang, East Java, Indonesia 65145. ✉ [indah@bsi.uin-malang.ac.id](mailto:indah@bsi.uin-malang.ac.id)

(Suzuki et al., 2001; Davis et al., 2003; Mealor & Dienes, 2013; Anohina-Naumeca, 2015). There have fewer studies that illustrate how structural knowledge constructs occur in a bilingual context that allows limited expression of structural knowledge.

Expressing structural knowledge in foreign languages is a difficulty. This study focused on the dynamics of research on structural knowledge that has not touched the realm of bilingualism. This study specifically seeks to answer the following three questions: (1) What are the patterns of structural knowledge of Indonesian EFL students?; (2) What are the factors influencing the structural knowledge?; and (3) How is the model of evaluation to stimulate student's structural knowledge?

Furthermore, this study departed from the assumption that student's structural knowledge in a bilingual context has certain diversity and patterns. It can be identified by relating to the framework of Mealor and Dienes (2013) on conscious and unconscious structural knowledge. In addition, the structural knowledge of students can be influenced by a number of aspects. Using Indah's (2016) framework, this was to figure out the effect of topic mastery and the flow of thought to students' structural knowledge. Furthermore, structural knowledge can be accommodated through an adequate evaluation model. Thus, the findings of this study will contribute to the process of developing an assessment model that can accommodate the ability of bilingual students to optimize their structural knowledge constructs, especially on their preferred topics.

## Literature Review

### *Structural Knowledge*

Structural knowledge is one of the important concentrations in education. The term structural knowledge can be used interchangeably with conceptual knowledge, connected understanding, and knowledge organizations (Trumpower & Sarwar, 2010). This is defined as knowledge of the relationships between key concepts (including facts, procedures, ideas, and rules) in a domain (Jonassen et al., 1993 in Trumpower & Sarwar, 2010). According to Mayer, structural knowledge theory is divided into four points, namely: 1) the concept of general schemes; 2) scheme as a description of knowledge; 3) the scheme has a structure related to the theme or concept; and 4) the scheme includes 'slots' filled with specific information. Structural knowledge theory describes the process of someone using, remembering and using knowledge (Neiles, 2014). According to Barret (in Neiles, 2014) structural knowledge describes the act of receiving new information from students, which requires the assimilation of new information with existing concepts. The target is not to duplicate already known information, but students can have a 'product', a new concept of assimilation between information.

One's structural knowledge has an influence on individual attitudes in responding to surrounding social phenomena. Someone who has low structural knowledge tends to apply an understanding of the relationship of ambivalent characteristics accompanied by doubt (Hutchens et al., 2015, p. 125). Conversely, one with qualified structural knowledge can think critically in response to various information s/he gets. Accordingly, structural knowledge has a major influence on the attitude patterns of an individual (Hutchens et al., 2015). Structural knowledge can also be used as an assessment of students' ability to understand a concept or lesson. It was recently developed in an effort to control the environment. Burkolter et al. (2010) explained that the treatment of environmental control is determined based on knowledge in operating the system as procedural knowledge and substantial knowledge of ecology and its impact on the surrounding environment.

In the context of learning, the ability of students to explicitly explain their understanding can be seen from the relationship between the words used and their meanings. Anderberg (2000) has identified the character of the relationship between verbal expressions and students' thoughts about the conceptions on certain issues. Building structural knowledge turned out to generally involve three different modes of discourse: socially-oriented, fact-oriented, and explanation-oriented (Lipponen, 2000). In this case, a strategic transfer is needed as spontaneous access to the taking of ideas and concepts that have been learned previously to produce new knowledge (Phye, 1992).

### *Topic Mastery and Flow of Thought*

Topic mastery begins with understanding the conceptual component that connects one information to the pre-existing knowledge structure (McNeil, 2011). This information relationship is realized by building associations between meanings. Meaning learned in language studies is inseparable from the structure of different units such as sentences, phrases, words, morphemes, and so on (Umagandhi & Vinothini, 2017). Leech, divides "meaning" into six parts. Associative meaning is one of the semantic parts consisting of connotative meaning, social meaning, affective meaning, reflected meaning, and collective meaning (Umagandhi & Vinothini, 2017). The ability of associative meaning develops based on experience and links the meaning of experience that shapes knowledge of learning outcomes (Abrahamse, 2016) that support cognitive flexibility (Pontes et al., 2019).

Understanding structural knowledge not only from topic mastery but also the flow of thought that clarifies the associative meaning between the concepts learnt. In Indah's (2016) framework, topic mastery was identified from clarity in defining the concept. In addition, the measured structural knowledge can also be seen from the inferencing

skills represented in writing. Meanwhile, the flow of thought is reflected in several indicators, namely the ability to answer questions through a systematic answer and providing details. Language use is also one of the important criteria indicating the flow of thought.

## Methodology

### *Research Design*

This study examined the structural knowledge of Indonesian EFL students. It employed a case study design as it attempted to see the pattern of students' structural knowledge, the factors affecting their structural knowledge and the assessment model of structural knowledge. The preliminary observation on EFL students of an Indonesian state Islamic university showed that the students' structural knowledge varied and some students faced difficulty to make explicit their structural knowledge.

### *Participants*

The participants of this study were EFL students (N=120) of a state Islamic university in Malang, Indonesia. They took English Literature department and the content course chosen is psycholinguistics. Specifically, this study observes the ability of third-year students on psycholinguistics concepts. The participants were assumed to have sufficient ability to represent their structural knowledge. During this period, students were deemed to have no significant difficulties when using written and oral English as they have passed the proficiency test in English intensive course.

### *Data Collection Instruments*

The research instruments covered a Psycholinguistics test and a questionnaire. As the primary data, the writing test was in the form of essays to examine the structural knowledge in a Psycholinguistics course. The participants were asked to work on the midterm essay writing test. To maintain the validity, the scoring of the test results involved two raters in order to achieve objectivity in the assessment and identification of problems that appear from the essay test answers. The reliability was achieved by making sure that all the participants had a consistent environment in taking the test and ensure that they were familiar with the assessment. In addition, both raters agreed on applying the same scoring procedure.

Of the three Psycholinguistics classes with a total of 120 students, 100 answer sheets were taken as data. The reduction was carried out on the incomplete answer sheets and illegible handwriting to avoid misinterpretation of data. The secondary data was in the form of questionnaire results regarding problems in the repetition of structural knowledge and the appropriate assessment format. The questionnaire was distributed online to all participants and lecturers of the English Literature program, although only a part of them responded to the questionnaire completely.

In the implementation of the psycholinguistics test, the participants were given a maximum of 90 minutes to work on essay questions which included two parts, teacher-generated topic and student-generated topic. In the teacher-generated topic section, students were asked to choose two (out of six) questions as follows: (A) In slips of the tongue, is it true that the speech production error occurred in the phoneme, word, or syllable? Give an example. (B) Psycholinguistics is interested in language performance. What does it mean? Can you give an example? (C) What do you know about the relationship between language comprehension and working memory? (D) How is the process of language production? Give examples of its process. (E) Hesitation may have its intention. What do you know about its purposes? (F) How do people self-monitor their speech? Can you explain and give an example? The test was conducted in a closed book to measure the extent to which students can maximize the construct of their structural knowledge and present it in their own sentences.

In the student questionnaire, participants were asked to respond to three questions, namely how to answer essay questions that were often prioritized, how to recognize whether the essay answers were satisfactory, and the types of difficulties that were often encountered when answering essay questions. In the lecturers questionnaire, in addition to the same three points identified from their experience of correcting essay answers, there were open items about the suggestion of an ideal essay assessment form to accommodate students' structural knowledge.

### *Data Analysis*

The collected data were analyzed by referring to Meador and Dienes' (2013) framework to identify the student's pattern of structural knowledge. In addition, to focus the discussion only on the factors affecting students' structural knowledge, Indah's (2016) framework of the topic mastery and flow of thought was employed.

## Results

The test obtained the data on the type of topic preference which was the first indicator of the elaborated concept. As shown in table 1, participants chose a basic general concept (77%) compared to specific topics such as language production or language understanding on self-generated topic. However, the participants made different choices on

teacher-generated topics, where specific concepts were preferred (55%). Judging from the accuracy of students' structural knowledge, high scores appeared on the ability to explain general concepts both on the student-generated topics (3.8, SD = 1.1) and teacher-generated topics (3.6, SD = 0.8). It indicates that the choice of preferred topic may not necessarily result in better accuracy of test answers.

Table 1. Topic preference & score of structural knowledge

Student-generated topics	%	Mean (SD)	Teacher generated topic	%	Mean (SD)
Basic concept of Psycholinguistics	77	3.8 (1.1)	Psycholinguistics-basic concept	23	3.6 (0.8)
Language Production	12	3.3 (0.9)	Psycholinguistics-language production	16	3.0 (0.9)
Language Comprehension	11	3.4 (0.8)	Psycholinguistics-language comprehension	6	3.0 (0.6)
			Language production-Language comprehension	55	3.5 (0.8)

The following is a sample answer of student-generated topics with a high score (4.5): "Psycholinguistics discusses how language is acquired since we were born in this world. Once the process of internalization of the first language is failed, it would affect how one communicates within society. The example is when a child in her first grade can make a speech in front of her class, it is a good indicator that she has internalized from an early age the process of language comprehension, production, and acquisition." (ZF.3)

The following sample is student-generated topics with low score (1), which also involves code mixing with Indonesian: "Concept of Psycholinguistics about slips of tongue which slip of tongue is a mistake error, *yang terjadi ketika kita berbicara* (occurring when we speak). When we will say p in our mind, but b that we say in my mouth" (AIF.3)

On teacher-generated topics, the following sample got a high score (4.5): "The first process is conceptualizing what we will say as the representation. Second, generating the words to say. Third, articulating the word in mind as a linguistic form. Then we do self-monitor to what we said. For example, we feel something weird in our stomach, then we recognize that we are hungry. The linguistic form of "I am hungry" is then uttered in a proper situation." (NF.2)

The sample of teacher-generated topics gaining low score (1.5) is: "Yes, it is right that psycholinguists are interested in language performance, it means that the result in psycholinguistics is not that important. E.g. That's why in some research we cannot use test as method, because it tests the result not performance." (MYI.1)

As for the data obtained through questionnaires, there are differences regarding the strategies used in presenting structural knowledge as summarized in table 2. The students stated that they always tried to prioritize answers that critically give the reasons that support their opinions (36%) and complete responses with suitable examples (25%). But on the other hand, the lecturers stated that in general student essays tend to answer questions directly and concisely (39%) and show an effort to give reasons with critical arguments (24%).

Table 2. The strategy mostly used to present structural knowledge

Strategies	Student response (%)	Teacher response (%)
Arguing critically	36	24
Answering in brief and direct	20	39
Providing example(s)	25	14
Referring to context	15	12
Defining given terms	4	13

The test results indicated two main problems in representing structural knowledge, namely topic mastery and the flow of thoughts as described in table 3. Difficulties in the topic mastery occurred when students explained concepts that they understood (20%). As for the problem of thought flow, difficulties arose when students explained an argument using the correct diction in English (30%) and completing the answer with an appropriate example (30%). The findings of the test and the questionnaire correspond to each other. The questionnaire indicated that the students mentioned weaknesses in making conclusions (28%) and responding adequately in English (56%). As for the experience of the lecturer correcting essay answers, the predominant difficulty occurs when explaining concepts that have been understood (62%) and explaining answers systematically (12%). The data from the lecturers based on their experience in assessing students are in line with the findings from the test results.

Table 3. Problems in representing structural knowledge

Topic mastery	%	Student response (%)	Teacher response (%)	Flow of thought	%	Student response (%)	Teacher response (%)
The clarity in defining the concept	20	7	62	Systematic answer	25	7	12
Inferencing skill	15	28	11	Providing details	30	2	5
				Language use	30	56	10

The following is the sample answer with the issue of topic mastery and flow of thought on student-generated topics: "The concept of psycholinguistics is about the language in the psychological area. When someone has a problem with the language, it means it is about the psycholinguistics" (US.3)

This answer shows a problem of topic mastery and flow of thought on teacher-generated topics: "Psycholinguistics explains about language in psychology. We can know his feeling when he said. How to know about that, we have to learn psycholinguistics" (ARM.1)

The results of the questionnaire in table 4 obtained some input regarding the ideal construct of structural knowledge assessment. The students said the scale of knowledge evaluation in essay questions needed to place the highest weight on the ability to explain critically exploration of material understanding (50%). Besides, appreciation is needed for answers that are accurate following the reference material recommended in the course (25%). From the perspective of the lecturer, the assessment in the form of essay questions should measure the quality in representing the results of understanding the material (50%). Similar to students, the lecturers view the ability to answer critically as an emphasis of assessment (25%). Besides, an ideal structural knowledge assessment includes the following conditions: (1) it uses simple and easy to understand language ; (2) it stimulates a high level critical thinking skills; (3) it shows a clear context so that students are able to explore their arguments appropriately; and (4) it refers to the question specifications strictly related to the course materials.

Table 4. The priority of structural knowledge assessment

Aspects	Student response (%)	Teacher response (%)	Other
Critical in arguing ideas	50	25	Use simple and understandable language
Qualified in representing knowledge	15	50	Stimulate higher-order critical thinking
Broad in elaborating knowledge	10	20	Clear context to support argument exploration
Accurate in referring to credible resources	25	5	Specification to materials given in the course

## Discussion

### *Type of Structural Knowledge of Indonesian EFL Students*

Structural knowledge begins with the type of topic preferences that the data show a tendency to fundamental concepts so that they are more easily elaborated (see Table 2). The findings of this study also indicate that choices on topics that are preferred do not necessarily result in better accuracy of test answers. It is in line with Ermis and Iccolioglu (2017) that students' explicit knowledge is influenced by metacognition which will consistently increase as an awareness to sharpen their learning strategies.

Furthermore, the construct of structural knowledge at the basic concept level becomes the basis for the development of relations between meanings that have a continuous association (Klock et al., 2019; Jonassen et al., 2013). Student's preference was made as the beginning of the structural knowledge order (see Table 1) that also represents the understanding of concepts oriented from student's interest (Sorge et al., 2019). In this case, the preference made by the participants represented topic mastery (Stapleton, 2001).

From the scores of structural knowledge, there is a difference between an understanding of general concepts and specific concepts. Here, it characterizes the meaning of the associative learning process. Failure to associate conceptual relations as thought processes from concrete to abstract results in a weakening of the structural knowledge construct (e.g. datum AIF.3 and MYI.1). One of the triggers for the weak construct is the lack of interwoven as associative property (Barnett & Ding, 2019). Borrowing the term continuous meaning or associative meaning (Umagandhi & Vinothini, 2017), learning with the development of structural knowledge construct is inseparable from the student's effort to link concepts from general to specific, from fundamental to complex.

The main objective of developing structural knowledge is to help students to use the information on other occasions effectively and efficiently (Nechita, 2014). Thus, table 2 shows that the ease of accessing structural knowledge constructs in the form of expressive representation certainly requires a variety of strategies to facilitate the delivery of what the students comprehend. The participants in the study showed various communicative ability in the test

responses. It needs special attention especially on Indonesian students studying English as a foreign language (Dagarin, 2004).

The ability to communicate the structural knowledge construct does not mean moving information input into output formations in the same composition. From various essay answers, students show structural knowledge governance pattern. The deductive explanation pattern appears in the answers with high scores (e.g. sample ZS.3 and NS.2). As for the low-achiever, the reasoning patterns do not always refer to both deductive and inductive inference. According to Coetzee and Monti (2018), it can occur due to working memory load and general cognitive difficulty making it difficult for them to determine which information is best to convey and construct in such a way. In the Mealor and Dienes (2013) scheme, it is stated that structural knowledge is divided into two lines, namely conscious and unconscious. In the high-achiever group, essay answers are based on judgment knowledge consciously composed and taken from the constructs of rules and rearrange the understood information. As for the low-achiever group, the essay answers are based on judgment knowledge, which is divided into conscious and unconscious. The construct of conscious answers is rooted in intuition and mastery, while the answers from unconscious flow only come from allegations taken from the students' long term memory.

Based on the understanding and initial mechanism of the structural knowledge construct above, it is necessary to redefine how learners effectively develop their structural knowledge patterns. From the questionnaire, the aspect on arguing critically has received agreement regarding the strategy to represent structural knowledge (60%). It is relevant to Inhoff et al. (2018) that students who can develop cognition from semantic meaning and perception will simultaneously support the ability to make decisions in their test response. The development of this cognition will form the maturation of logical reasoning (Swestyani et al., 2018).

#### *Factors Affecting the Structural Knowledge*

In general, the difficulty of representing structural knowledge by referring to Indah's framework (2016), is divided into two, topic mastery and flow of thought. Topic mastery in this study is dominated by the difficulty of explaining a concept that has generally been recognized and understood. Still, when represented again by paraphrasing, it is not always easy. The flow of thought includes the ability to explain systematically, provide detailed answers in the form of examples under the context requested, and use language appropriately, especially in selecting diction that facilitates the reader's understanding (see table 3).

In this case, the role of topic mastery is also supported by McNeil's study (2011) on the reading skills of twenty English students that proved mastering topics support better performance in writing essays to represent structural knowledge. The finding of this study is also corroborated by Bacha (2010) which involved teacher-generated topics and Delaney (2008) that students could make analytic writing or essay responses that were more critical than just making resumes on the topic they master.

The flow of thought presented by students in their writing is much influenced by the application of the transition, writing format, detailed information and use of language (Indah, 2016). More students show ineffective transitions confirmed by difficulties in paraphrasing and using quotes. It means that the way students write is dominated by putting relevant references together in their papers without considering how to organize ideas so that the flow of thought is well organized. In Indah's (2016) research, it appears that students also show a lack of awareness to use the right writing format. In general, presenting sufficient detailed information is not a problem for most students because the paper shows the completeness of the information that can facilitate the reader's understanding. In the use of language, some students have the right competencies in using the correct grammar and the right vocabulary. However, the mistakes they make do not contribute much to their meaning. What distinguishes these findings with this research is the test method, where in the form of structural knowledge in essay writing in a closed book, the obstacles faced are evident in three main points: the answer system, the choice of examples and the use of language.

Language constraints become one of the obstacles in the representation of structural knowledge. As shown in the questionnaire 56% of the participant confirmed that it was not easy to construct the wording in English language, or in other words, the problem occurs in relating between semantic and lexical associations (Vivas et al., 2019). The construction of this meaning is very significant, especially in English language learners as a foreign language in developing countries (Ingerpuu-Rummel, 2018). The ability to construct meaning is included in one of the critical thinking skills needed to express structural knowledge. This skill does not stand alone because it follows another skill, namely language skills. It is in line with the logic that being a critical thinker is characterized by effective communication (Paul & Elder, 2019).

In the findings of this study, it appears that one difficulty will overlap with other problems (see sample US.3 and ARM.1 in the result). The difficulty in explaining the understanding of a concept makes the essay answer concise but not easy to read or otherwise long but has no essence. The difficulty in the realm of topic mastery is supported by the challenge of the flow of thought in the form of language constraints to represent structural knowledge in English appropriately. Likewise, it is difficult to make conclusions that clarify the types of answers using deductive or inductive reasoning. This difficulty is supported by the inability to express ideas systematically, which can be characterized by the use of

transition of ideas that clarify sentences. The relationship between language skills and structural knowledge representation as an indication of critical thinking is in line with empirical findings in students in various countries (Iwaoka & Crosetti, 2008; Oliver-Hoyo, 2003; Quitadamo & Kurtz, 2007).

#### *Assessment Model of Structural Knowledge of EFL Students*

Assessing student essays means evaluating or gathering information to see the extent of which structural knowledge can be represented. In the context of foreign language learning, the focus of assessment generally lies in the language used, but it differs from the essay assessment in content courses like psycholinguistics. In this case, the assessment is not just about the use of language in the context of learning, but the aim is to display language proficiency in mastering the content (Weigle, 2007). The mastery of content shown in table 1 and 2 was assessed not only from the language used but also the fulfilment of structural knowledge as a pattern to be observed. It certainly requires the ability to express verbally correctly (Hasanudin & Fitriainingsih, 2020).

From the findings of this study, several priority assessments were based on student-generated topics (see Table 1). The aspect on elaboration of explanation did not get approval from the response of students and lecturers because the length of the answer does not correlate with the accuracy of the structural knowledge representation. Similarly, the aspect of accuracy in referring to credible sources is not assessed since the test type is closed book. It would be different if measured from the paper assignments. The categories of functional assessments to accommodate structural knowledge representations include: (1) measuring the quality of representing the results of material understanding, and (2) testing the ability to answer questions critically. To measure quality, essay questions should use simple and easy to understand language; and refer to the specification of questions that are closely related to the course material. For quality assessments, the recommendation for compiling questions is to use language that is easy to understand. It is in line with the opinion of Peha (2003) that good judgment uses specific and appropriate vocabulary to describe the observed patterns.

Designing accommodative assessments to measure structural knowledge is not easy because each teacher is faced with a diverse collection of conceptions about what is relevant to student understanding in class. It is as represented in table 4 that the assessment should cover several criteria that are different in the point of view of students and lecturers. According to Khiat (2010 in Hamer & van Rossum, 2020), errors in the assessment model can make the learning and teaching not effective in compromising the benefits of education.

Assessments on structural knowledge as seen in table 4 do not focus on testing memory, but rather on the reproduction of concepts towards higher quality learning (Hamer & van Rossum, 2020). Both teachers and students in this study argued that structural knowledge is best assessed through the criteria of critically presenting ideas and knowledge. It means the assessors do not 'measure' writing as a scientist; instead, he is a humanist who analyzes thought and reasoning - both hermeneutic and rhetorical performances - from other humans (Petruzzi, 2008). In this case, it is essential to remember that students' performance in writing their essay answers can also be assessed using criteria or by setting standards (Crook, 2015).

In table 4, participants of this study offered the criteria concerning clear context to support argument exploration and to stimulate higher-order critical thinking. Providing a clear context is also mentioned by Jarvie and Beymer (2019) in their study for increasing the skills of meaningful learning. In addition, context clarity refers to the core of assessment quality (Schuwirth & van der Vleuten, 2003). The participants of this study also listed specification to materials in the psycholinguistic course as another assessment criterion. The assessment is considered to achieve a balanced proportion in terms of the context and concept being tested. Therefore, the potential concept map model is to be implemented in designing essay problem assessments to measure structural knowledge (Anohina-Naumeca, 2015).

In this study, the format of an essay type test is used. However, because it also created a certain problem for students of low achiever (see Table 2), another format can be used as an alternative. A concept map can be an alternative that is very helpful to clarify the logic of learners' thinking. It can present the structural knowledge in a graphical or network form (Neiles, 2014). The concept map method can increase student creativity to work on projects that require clearer reasoning, as found by Lin and Chuang (2014). It also has the potential to measure structural knowledge in the form of concept assessments that is adaptive to support the diversity of students in the level of language proficiency (Anohina-Naumeca, 2015). In short, concept maps can serve a useful, productive, and facilitative role (Novak & Canas, 2010).

### **Conclusion**

As a conclusion of this study, the structural knowledge equipped with meaningful and continuous relationships between concepts if placed in a bilingual context can create its own difficulties. This study is an attempt to answer the needs of empirical findings on the construct of student's structural knowledge in the bilingual context, by looking at the factors that influence it. In addition, it is also to recognize the right assessment model, which accommodates the ability of students to elaborate their structural knowledge in the context of foreign language learning. Three important formulations are found in this study.

First, the structural knowledge of Indonesian EFL students is explicit as it is influenced by meta-cognition, which will consistently increase with the awareness to learn using associative meanings. The generally fundamental topic preferences are also affected by the students' motivation and interest orientation. The deductive explanation pattern appears in the structural knowledge representation of high achieving students while in low achieving students the reasoning patterns do not always refer to both deductive and inductive inference. In the high achieving group, the essay answers are based on judgment knowledge that is consciously composed and taken from the constructs of rules and rearranges information that is understood. As for the low-achieving group, the essay answers are based on judgment knowledge which is divided into conscious and unconscious. The construct of conscious answers is rooted in intuition and mastery, while the answers from unconscious flow only come from allegations taken from the students' long term memory.

Second, this study found two main aspects of difficulty representing student's structural knowledge, namely topic mastery and flow of thought. Topic mastery in this study is dominated by the difficulty in explaining a concept that has generally been recognized and understood, but when represented again by paraphrasing, it is not always easy. In the findings of this study, it appears that one difficulty entails another. Difficulty explaining the understanding of a concept makes the essay answer concise but not easy to understand or otherwise long but has no essence. The challenge in the realm of topic mastery is supported by the difficulty of the flow of thought in the form of language constraints to represent structural knowledge in English appropriately. Likewise, the difficulty occurs in making inferences using deductive or inductive reasoning. It follows the inability to express ideas systematically characterized by the use of transition of ideas that clarify sentences.

Third, this research gave birth to the formulation of an assessment model that accommodates structural knowledge representation, including (1) measuring the quality of representing the results of material understanding, and (2) testing the ability to answer questions critically. To measure quality, essay questions should use simple and easy to understand language; and refer to the specification of questions that are closely related to the course material. As for testing the arguments in the answers required essay questions that stimulate critical thinking skills at a high level; and show a clear context so that students can explore their arguments appropriately in the context of English as a foreign language.

### Recommendations

This research was limited to third-year students of Islamic tertiary institutions in Indonesia who study Psycholinguistics courses in English language assessment. To increase the transferability of findings, further research is needed on a broader scale, involving more subjects studying several courses to identify the same or different trends. In addition, future research can examine the formulation of the assessment model suggested in this study, for instance by using a concept map to assess EFL student's structural knowledge.

### Acknowledgements

The authors would like to thank the students who provided research information. Thank you for Prof. Irwan Abdullah for insightful suggestions to complete this research article and the Faculty of Humanities, Universitas Islam Maulana Malik Ibrahim Malang that supports the funding of this research.

### References

- Abrahamse, E., Braem, S., Notebaert, W., & Verguts, T. (2016). Grounding cognitive control in associative learning. *Psychological Bulletin*, 142(7), 693-728.
- Anderberg, E. (2000). Word meaning and conceptions. An empirical study of relationships between students' thinking and use of language when reasoning about a problem. *Instructional Science*, 28, 89-113. <https://doi.org/10.1023/A:1003612324706>
- Anohina-Naumeca, A. (2015). Justifying the usage of concept mapping as a tool for the formative assessment of the structural knowledge of engineering students. *Knowledge Management & E-Learning*, 7(1), 56-72. <https://doi.org/10.34105/j.kmel.2015.07.005>
- Bacha, N. N. (2010). Teaching the academic argument in a university EFL environment. *Journal of English for Academic Purposes*, 9(3), 229-241. <https://doi.org/10.1016/j.jeap.2010.05.001>
- Burkolter, D., Meyer, B., Kluge, A., & Sauer, J. (2010). Assessment of structural knowledge as a training outcome in process control environments. *Human Factors*, 52(1), 119-138. <https://doi.org/10.1177/0018720810367646>
- Coetzee, J. P., & Monti, M. M. (2018). At the core of reasoning: Dissociating deductive and non-deductive load. *Human Brain Mapping*, 39(4), 1850-1861. <https://doi.org/10.1002/hbm.23979>
- Crook, J. (2015). *Substantive critical thinking as developed by the Foundation for Critical Thinking proves effective in raising SAT and ACT test scores*. The Critical Thinking Community.



<http://www.criticalthinking.org/pages/substantive-criticalthinking-as-developed-by-the-foundation-for-critical-thinking-proves-effective-inraising-sat-and-act-test-scores/632>.

- Dagarin, M. (2004). Classroom interaction and communication strategies in learning English as a foreign language. *ELOPE: English Language Overseas Perspectives and Enquiries*, 1(1-2), 127-139. <https://doi.org/10.4312/elope.1.1-2.127-139>
- Davis, M. A., Curtis, M. B., & Tschetter, J. D. (2003). Evaluating cognitive training outcomes: Validity and utility of structural knowledge assessment. *Journal of Business and Psychology*, 18, 191-206. <https://doi.org/10.1023/A:1027397031207>
- Delaney, Y. A. (2008). Investigating the reading-to-write construct. *Journal of English for academic purposes*, 7(3), 140-150. <https://doi.org/10.1016/j.jeap.2008.04.001>
- Fandakova, Y., & Bunge, S. A. (2016). What connections can we draw between research on long-term memory and student learning? *Mind, Brain, and Education*, 10(3), 135-141.
- Farmer, J., Knapp, D., & Benton, G. M. (2007). An elementary school environmental education field trip: Long-term effects on ecological and environmental knowledge and attitude development. *The Journal of Environmental Education*, 38(3), 33-42. <https://doi.org/10.3200/JOEE.38.3.33-42>
- Gonzalez-Fernandez, B., & Schmitt, N. (2019). Word knowledge: Exploring the relationships and order of acquisition of vocabulary knowledge components. *Applied Linguistics*, 40(1), 1-26. <https://doi.org/10.1093/applin/amy057>
- Hamer, R., & van Rossum, E. J. (2020). Students' conceptions of understanding and its assessment. In E. Cano & G. Ion (Eds.), *Innovative Practices for Higher Education Assessment and Measurement* (pp. 140-161). IGI Global.
- Hasanudin, C., & Fitrianiingsih, A. (2020). Verbal linguistic intelligence of the first-year students of Indonesian education program: A case in reading subject. *European Journal of Educational Research*, 9(1), 117-128. <https://doi.org/10.12973/eu-jer.9.1.117>
- Hutchens, M. J., Hmielowski, J. D., & Beam, M. A. (2015). Rush, Rachel, and Rx: Modeling partisan media's influence on structural knowledge of healthcare policy. *Mass Communication and Society*, 18(2), 123-143. <https://doi.org/10.1080/15205436.2014.902968>
- Indah, R. N. (2016). Topic mastery and flow of thought of Indonesian students learning psycholinguistics. *Journal of Education and Practice*, 7(29), 151-156.
- Ingerpuu-Rummel, E. (2018). Teachers' and learner participation opportunities in meaning construction for new words in the foreign language classroom. *Trames*, 22(1), 63-87.
- Inhoff, M. C., Libby, L. A., Noguchi, T., Love, B. C., & Ranganath, C. (2018). Dynamic integration of conceptual information during learning. *PloS one*, 13(11), e0207357. <https://doi.org/10.1371/journal.pone.0207357>
- Iwaoka, W. T., & Crosetti, L. M. (2008). Using academic journals to help students learn subject matter content, develop and practice critical reasoning skills, and reflect on personal values in food science and human nutrition classes. *Journal of Food Science Education*, 7(2), 19-29. <https://doi.org/10.1111/j.1541-4329.2007.00044.x>
- Jarvie, S., & Beymer, A. (2019). "We do investigate ourselves": Figurative assessment practices as meaning-making in English education. *Changing English*, (In Press), 1-11. <https://doi.org/10.1080/1358684X.2019.1647512>
- Kim, K. (2019). Graphical interface of knowledge structure: A web-based research tool for representing knowledge structure in text. *Technology, Knowledge and Learning*, 24, 89-95.
- Klock, A. C. T., Gasparini, I., Pimenta, M. S., & de Oliveira, J. P. M. (2019). Adaptive hypermedia systems. In M. Khosrow-Pour (Ed.), *Advanced Methodologies and Technologies in Media and Communications* (pp. 217-228). IGI Global.
- Lawson, M. J., Vosniadou, S., Van Deur, P., Wyra, M., & Jeffries, D. (2019). Teachers' and students' belief systems about the self-regulation of learning. *Educational Psychology Review*, 31, 223-251.
- Lin, C. C., & Chuang, H. M. (2014). A creative development in environment engineering education with mind mapping. *Advanced Materials Research*, 1006-1007, 1135-1138. <https://doi.org/10.4028/www.scientific.net/amr.1006-1007.1135>
- Lipponen, L. (2000). Towards knowledge building: From facts to explanations in primary students' computer-mediated discourse. *Learning Environments Research*, 3, 179-199.
- Liu, Y., Tong, Y., & Yang, Y. (2018). The application of mind mapping into college computer programming teaching. *Procedia Computer Science*, 129, 66-70.
- Martinez, D. (2019). Immediate and long-term memory and their relation to crystallized and fluid intelligence. *Intelligence*, 76, 101382. <https://doi.org/10.1016/j.intell.2019.101382>

- McNeil, L. (2011). Investigating the contributions of background knowledge and reading comprehension strategies to L2 reading comprehension: An exploratory study. *Reading and Writing, 24*, 883-902.
- Mealor, A. D., & Dienes, Z. (2013). The speed of metacognition: Taking time to get to know one's structural knowledge. *Consciousness and Cognition, 22*(1), 123-136. <https://doi.org/10.1016/j.concog.2012.11.009>
- Nechita, E. (2014). Teaching for long-term memory. In B. Iantovics & R. Kountchev (Eds.), *Advanced Intelligent Computational Technologies and Decision Support Systems* (pp. 201-209). Springer.
- Neiles, K. Y. (2014). Measuring knowledge: Tools to measure students' mental organization of chemistry information. In D. M. Bunce, & R. S. Cole (Eds.), *Tools of Chemistry Education Research* (pp. 169-189). American Chemical Society.
- Novak, J. D. & Canas, A. J. (2010) The universality and ubiquitousness of concept maps. In J. Sanchez, A. J. Canas, J. D. Novak, (Eds.) *Proceedings of the Fourth International Conference on Concept Mapping*. Vina del Mar, Chile.
- r-Hoyo, M. T. (2003). Designing a written assignment to promote the use of critical thinking skills in an introductory chemistry course. *Journal of Chemical Education, 80*(8), 899. <https://doi.org/10.1021/ed080p899>
- Paul, R., & Elder, L. (2019). *The miniature guide to critical thinking concepts & tools* (7th ed.). Rowman & Littlefield.
- Petruzzi, A. (2008). Articulating a hermeneutic theory of writing assessment. *Assessing Writing, 13*(3), 219-242. <https://doi.org/10.1016/j.asw.2008.10.005>
- Phye, G. D. (1992). Strategic transfer: A tool for academic problem-solving. *Educational Psychology Review, 4*(4), 393-421.
- Pontes, A. C., Mobley, R. B., Ofria, C., Adami, C., & Dyer, F. C. (2020). The evolutionary origin of associative learning. *The American Naturalist, 195*(1), E1-E19. <https://doi.org/10.1086/706252>
- Quitadamo, I. J., & Kurtz, M. J. (2007). Learning to improve: using writing to increase critical thinking performance in general education biology. *CBE—Life Sciences Education, 6*(2), 140-154. <https://doi.org/10.1187/cbe.06-11-0203>
- Schuwirth, L. W., & van der Vleuten, C. P. (2003). Written assessment. *The BMJ, 326*, 643-645.
- Sorge, S., Keller, M. M., Neumann, K., & Moller, J. (2019). Investigating the relationship between pre-service physics teachers' professional knowledge, self-concept, and interest. *Journal of Research in Science Teaching, 56*(7), 937-955. <https://doi.org/10.1002/tea.21534>
- Stapleton, P. (2001). Assessing critical thinking in the writing of Japanese university students: Insights about assumptions and content familiarity. *Written communication, 18*(4), 506-548. <https://doi.org/10.1177/0741088301018004004>
- Suzuki, H., Matsakis, P., & Desachy, J. (2001). Fuzzy image classification and combinatorial optimization strategies for exploiting structural knowledge. In *10th IEEE International Conference on Fuzzy Systems. (Cat. No. 01CH37297)* (Vol. 1, pp. 324-327). IEEE. <https://doi.org/10.1109/FUZZ.2001.1007314>
- Swestyani, S., Masykuri, M., Prayitno, B. A., Rinanto, Y., & Widoretno, S. (2018). An analysis of logical thinking using mind mapping. *Journal of Physics: Conference Series, 1022*, 1-8.
- Trumpower, D. L., & Sarwar, G. S. (2010). Effectiveness of structural feedback provided by Pathfinder networks. *Journal of Educational Computing Research, 43*(1), 7-24. <https://doi.org/10.2190/EC.43.1.b>
- Umagandhi, R., & Vinothini, M. (2017). Leech's seven types of meaning in semantics. *International Journal of Multidisciplinary Research and Development, 4*(3), 71-72.
- Uz, R., & Uzun, A. (2018). The influence of blended learning environment on self-regulated and self-directed learning skills of learners. *European Journal of Educational Research, 7*(4), 877-886. <https://doi.org/10.12973/eu-er.7.4.877>
- Vivas, L., Manoiloff, L., Garcia, A. M., Lizarralde, F., & Vivas, J. (2019). Core semantic links or lexical associations: assessing the nature of responses in word association tasks. *Journal of psycholinguistic research, 48*(1), 243-256. <https://doi.org/10.1007/s10936-018-9601-8>
- Weigle, S. C. (2007). Teaching writing teachers about assessment. *Journal of Second Language Writing, 16*(3), 194-209. <https://doi.org/10.1016/j.jslw.2007.07.004>