ISSN: 1817-6798 (Print)
Journal of Tikrit University for Humanities
available online at: www.jtuh.org/

Procedural Knowledge, Cognitive Load and their Correlation with Performance of Productive Skills for Iraqi EFL learners

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Keywords:
EFL,
Knowledge,
Procedural,
Productive ,
Skills

A R T I C L E I N F O

Article history:

Received	20 Dec 2023
Received in revised form	25 Dec 2023
Accepted	25 Dec 2023
Final Proofreading	19 Mar 2024
Available online	21 Mar 2024

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A B S T R A C T

Procedural knowledge that involves understanding how to perform tasks effectively, and cognitive load managing can be associated with the production of productive language skills. The current study is a correlational study, which aims to find out the type of connections between the learners' ability to utilize procedural knowledge, managing cognitive load, and the producing language. The sample of the study is 240 students at the third-year of English Department at Tikrit University in the academic year 2022/2023. The data is gathered through using two tools, a questionnaire to identify students' cognitive load types and two diagnostic tests to assess the level of procedural knowledge, cognitive load and productive skills' performance. Results of the study show that there is a significant correlation between students' procedural knowledge and writing skill, and there is a significant correlation between students' cognitive load and productive skills, that students response in germane cognitive load has the highest mean score and that the correlation is positive. The statistical means show also that there is no significant correlation between students' procedural knowledge and speaking skill .In the light of these results, some conclusions, recommendations and suggestions for further studies are presented.

DOI: http://doi.org/10.25130/jtuh.31.3.2024.22

المعرفة الإجرائية والعبء المعرفي وعلاقتهما بأداء المهارات الإنتاجية لدى متعلمي اللغة الإنجليزية كلغة أجنبية في العراق

زبيدة سمير عايد/قسم الاعلام– كلية الاداب– جامعة تكريت
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الخلاصة:

في هذا البحث المستل نبحث المعرفة الإجرائية والتي تتضمن فهم كيفية أداء المهام اللغوية بفعالية، مع

إدارة العبء المعرفي يمكن أن ترتبط بأداء الطلبة لمهارات اللغة الإنتاجية. تعد الدراسة الحالية دراسة ارتباطية تهدف إلى كشف نوع الارتباطات بين قدرة الطلبة على استخدام المعرفة الإجرائية ، وإدارة العبء المعرفي ، وارتباطهما بإنتاج واستخدام اللغة, وتألفت عينة الدراسة من 240 طالبًا و طالبة في السنة الثالثة من قسم اللغة الإنجليزية في جامعة تكريت في العام الدراسي 2023/2022. حيث تم جمع البيانات باستخدام أداتين، الاستبيان لتقييم أنواع العبء المعرفي لدى الطلبة، واختبارين تشخيصيين لتقييم مستوى المعرفة الإجرائية، العبء المعرفي ، وأداء مهارات الإنتاج اللغوية. أظهرت نتائج الدراسة أن هناك ارتباطًا معنويًا بين معرفة الطلاب الإجرائية ومهارة الكتابة، وهناك ارتباطًا معنويًا بين العبء المعرفي لدى الطلبة ومهارات الإنتاج اللغوية، وأن استجابة الطلبة في (النوع الثالث للعبء المعرفي) لديها أعلى متوسط درجة، وأن الارتباط إيجابي. واشارت الاجراءات الاحصائية إلى عدم وجود ارتباط معنوي بين معرفة الطلبة الإجرائية والمهارات اللغوية للكلام. استنادًا إلى هذه النتائج، تم تقديم بعض الاستنتاجات والتوصيات والاقتراحات لدراسات أخرى.

يعبر الباحثون عن شكرهم لمكتبة جامعة تكريت لرفد البحث بكل ماهو جديد

كلمات المفتاحية: متعلمين الانكليزية لغة أجنبية , المعرفة, الاجرائية, المهارات الانتاجية

1. Introduction

1.1 Statement of the Problem

English language learning is a complex process that requires the acquisition and application of various skills, including productive skills such as speaking and writing. For Iraqi learners of English as a Foreign Language (EFL), mastering these productive skills can be challenging due to several factors, including the influence of their native language, limited exposure to authentic English contexts, and the cognitive demands associated with language production (Jaramillo and Medina, 2011).

One key aspect that may enhance the performance of productive skills among Iraqi EFL learners is the level of procedural knowledge they possess. Procedural knowledge refers to the understanding and ability to apply the rules and conventions of language in real-time communication. It encompasses the knowledge of grammar, vocabulary, and discourse strategies necessary for effective speaking and writing (Rukminingsih et al., 2020). Additionally, cognitive load, which refers to the mental effort required to process information, that play a crucial role in the performance of productive skills. Engaging in language production tasks often involves managing various cognitive processes simultaneously, (Chandler and Sweller, 1991). This study aims to explore the

relationship between procedural knowledge, cognitive load, and the performance of productive skills for Iraqi EFL learners. By examining these factors, the study seeks to contribute to the existing body of knowledge on language learning and provide practical implications for educators, curriculum developers, and policymakers in Iraq's English language education system.

1.2 Aims of the Study

This study aims at finding out :

1- The relation between procedural knowledge and performance of productive skills for Iraqi EFL university students .

2- The relation between cognitive load and performance of productive skills for Iraqi EFL university students .

1.3 Questions of the Study

1. What is the type of correlation between students' procedural knowledge and their performance in productive skills?
2. What is the type of correlation between students' cognitive load and their performance in productive skills?

1.4 Limits of the Study

The present study is limited to :Iraqi EFL university third-year students at English Department / college of Education for Humanities / University of Tikrit. The academic year (2022-2023). Productive Skills (speaking and writing).

1.5 Value of the Study

This study is hoped to be valuable for:

1. Students: To get better advantage of procedural knowledge strategies to have better performance in writing and speaking. And a proper understanding of the cognitive load obstacles. It would promote students' awareness , allowing them to become more aware of their learning processes and enabling them to self-regulate their cognitive load during language learning.

2. Teachers: To help instructors by facilitating their role in teaching writing and speaking process . It may enhance teachers capacity to support students in acquiring procedural knowledge and managing cognitive load. This can lead to improved teaching practices.

3.Curriculam designer: To give periodical training course to teachers on constructing their teaching processes to handle cognitive load impact .

And to develop the targeted curriculum components that enhance procedural knowledge acquisition, subsequently improving students' proficiency in applying their skills in practical, real-world contexts.

2. Theoretical Background

2.1 Aspects of Knowledge

Person's knowledge that has the faces of when and how to implement a strategy appropriately called knowledge of cognition, knowledge of cognition includes knowledge used in approaching the questions ‘what’, ‘how’, ‘when’, and ‘why). Knowledge of cognition contains at least three aspects of cognitive awareness: declarative knowledge, procedural knowledge, and conditional knowledge, the three types of knowledge are related to each other and are able to predict each other, that the three aspects of knowledge share strong connections and have the capacity to anticipate one another (Ma and Baranovich, 2015).

2.2 Procedural Knowledge

Jiamu (2001) points out that procedural knowledge is the knowledge about how to do something. It needs motor skills, cognitive skills, and cognitive strategies. Rukminingsih, et al (2020) indicate that procedural knowledge is the knowledge about how to apply something. For instance, in writing, procedural knowledge is the knowledge how to apply the rule of writing in communication. It is the knowledge that related to how to perform an action with clear procedures, as the knowing how to follow the steps/strategies involved, e.g., the steps involved in multiplying mixed numbers or the best ways to make a tuna fish sandwich (Azevedo & Aleven, 2013). It is about strategies that can be used to achieve success in accomplishing a task. It is the knowledge about the strategies which can be used to improve performance (Backer, et al., 2011).

According to Suroso (2010) procedural knowledge in English is the knowledge about how to use the language. So it can be concluded that procedural knowledge in productive skills means the knowledge about how to use process, strategies, skills correctly, whether the function of each process and the formulas, both of in spoken and written and apply it properly in communication.

2.3 Characteristics of Procedural Knowledge of Students Performance

Meijer, et al. (1999) formulate the main characteristics that describe procedural knowledge of students' performance: **The first**, personal procedural

knowledge denotes an individual's knowledge, which is unique to them. This knowledge has a personal meaning for the individual based on his/her personal sense-making processes and experience. **Second**, the contextual characteristic is defined as being in classroom situations'. This may also be unique but not as dependent on the individuality of the learners, rather on the whole teaching–learning situation, which may occur in the classroom. **The third** characteristic, reflective, may be individual again depending on the length and richness of the learner's experience. **The fourth**, is attributed to procedural knowledge is being tacit. Tacit knowledge is always personal, involving the emotions and values of the individual, closely connected to the teacher's individual beliefs and context . Being rooted in the teacher's actions, experience and thoughts, it is not easily visible or explicable. **The last** characteristic, describes the learner's procedural knowledge related to the certain content taught in the classroom. Based on these characteristics, Meijer et al.(1999) formulated the procedural knowledge as '…knowledge and beliefs that underlie his or her actions; this kind of knowledge is personal, related to context and content, often tacit, and based on (re-reflection on) experience.

2.4 The Concept of Cognitive Load

The term Cognitive load refers to the number of working memory resources that have been used already. It typically increases when unnecessary pressure or demands get imposed on a learner. These demands could be inadequate teaching methods that are used by educators or any other unnecessary distractions in a classroom. Atkinson and Shiffrin (1968) refer to the cognitive load as process of information access to our working memory can interact at any given time. For educational purposes, cognitive load helps us to avoid overloading learners with more than they can effectively process into schemas for long-term memory storage and future recall.

According to Sweller, et al. (2011), cognitive load refers to the amount of information that the working memory can hold at any one given time. Most people can handle a cognitive load of between 3 and 7 separate pieces of information. It is a task that cognitive effort (or amount of information processing) required by a person to perform that task. Cognitive load caused by learning tasks, prior knowledge, complex information that can hamper the student's ability to process fresh information. (Small et al.,2001).

2.5 Cognitive Load Theory (CLT)

In the late 1980s, Sweller researched that CLT is based around the idea that our working memory which is the part of our mind that processes what we are currently doing , can only deal with a limited amount of information at one time, this would affect the capacity of acquired/ learnt materials, so he created CLT to enhance students' ability. CLT is a theoretical model of learners' working memory and the different categories of load that can fill their memory capacity. The most influential iteration of this theory, is partitioned the working memory demands of instructional settings into three load types, intrinsic load, extraneous load, and germane load. This model assumed that learning materials have an inherent complexity that stems from the number of information units and the number of their connections, termed as "element interactivity" (Sweller et al., 2011).

CLT suggests that if the cognitive load exceeds our processing capacity, we will struggle to complete the activity successfully. In summarizing CLT, De Jong states that 'cognitive load theory asserts that learning is hampered when working memory capacity is exceeded in a learning task'. (De Jong, 2010).

2.6 Types of Cognitive Load

Cognitive load theory identifies three different types of cognitive load: intrinsic, extraneous and germane load . Intrinsic cognitive load relates to the inherent difficulty of the subject matter being learnt. More specifically, material that contains a large number of interactive elements is regarded as more difficult than material with a smaller number of elements and/or with a low interactivity (Sweller,2005).

Materials differ in their levels of element interactivity and thus intrinsic cognitive load, and they cannot be altered by instructional manipulations…". That there are some types of content seem to be intrinsically more difficult than others.

According to van Merrienboer and Sweller (2005), extraneous cognitive load relates to how the subject matter is taught: "Extraneous cognitive load … is load that is not necessary for learning . It is cognitive load that is evoked by the instructional material and that does not directly contribute to learning. A combination of high intrinsic and high extraneous cognitive load may be fatal to learning because working memory may be substantially exceeded (Sweller, et al, 1998).

Germane cognitive load refers to the load imposed on the working memory by the process of learning that is, the process of transferring information into the long-term memory through schema construction (ibid).

The combination of decreasing extraneous cognitive load and at the same time increasing germane cognitive load involves redirecting attention: Learners' attention must be withdrawn from processes that are not relevant to learning and directed towards processes that are relevant to learning and, in particular, toward the construction and mindful abstraction of schemas.

2.7 The Five Principles of Reducing Cognitive Load

Richard (2003) states that there are five principles that teachers can use to help reduce cognitive load and thus, increase retention and progress by students: **The Coherence Principle:** Quite simply, the coherence principle involves reducing the amount of information on each slide/page/worksheet to only that is necessary. Images, sounds and words that are not essential, add to cognitive load, giving the student's working memory fewer stimuli to focus on enables more processing power to be used by the germane load . **The Signaling Principle**: It is the using of cues or signals to draw attention to important information or guide learners through a process. This principle is designed to reduce extraneous cognitive load, allowing learners to allocate more cognitive resources to essential, relevant information, and to help students focus on the information. **The Redundancy Principle**: Students learn best from images and narration, rather than text and narration. Images (visual) and narration (audio) do not compete with each other, therefore they use less cognitive load. This is known as the "Modality Effect". Basically, don't put lots of text on resources and definitely don't just read out the text. **Spatial Contiguity**: Placing labels next to the thing they are describing, so students don't have to waste cognitive load working anything out (ibid).

It's all about making the working memory's job easier in terms of intrinsic and extraneous load so students have more use of germane load, the ability to make those connections with previously learned information. **Temporal Contiguity**: Last but not least is temporal contiguity. This one is achieved simply by presenting the visual images and their labels at the same time. By doing this, the working memory knows they should be treated as an individual unit rather than separate entities (Richard ,2003)**.**

2.7 Productive Skills

Productive language skills, speaking, and writing, are important because they are the observable evidence of language acquisition. The more the speaker or the writer produces appropriate and coherent language the more we have proof of the progress in the learner's language system. Productive skills, speaking and writing, are presented by Jaramillo and Medina (2011) as an important form of expression used to persuade or convince other people as well as to share ideas and feelings.

Oral and written skills are categorized as productive skills which require learners to produce rather than receive information through language (Harmer, 1991). In the language educational setting, through speaking and writing activities, students are given the opportunity to experience with the target language. Writing serves as a constructive avenue for practicing grammar structures, aiding learners in revisiting and assimilating fresh vocabulary, and grasping the rules of English punctuation. Moreover, it nurtures learners' autonomy when they engage in tasks such as maintaining journals or submitting routine writing assignments conducted independently at home. Skill of speaking is vital unless someone is learning English purely for academic reasons and does not intend to communicate in English, which is quite rare. Good command on speaking skills develop a real sense of progress among learners and boosts their confidence.

2.8 Procedural Knowledge and Productive Skills

The links between thought, speech, and writing play a central role in adapting procedural knowledge . Students learn that if they can have it, they can say it. They can write and speak. Writing is something beyond communication. They focused on writing skills; however, need the learners to use procedural knowledge to communicate effectively. The whole purpose of education and motivation in the classroom is to enable the student to think for himself with the knowledge he has, instead of mechanically feeding unnecessary and irrelevant information (Starko, 2009).

Teachers should be aware of at least two perspectives. The first is that language, orally and on written, is an essential tool for conveying creative ideas, strategies, and solutions across disciplines. Students may write about math problems, ideas, science, social studies, or any other field. The second view is that schools may play a role in supporting the inherent creativity of language arts (ibid).

Procedural knowledge and productive skills are related that procedural knowledge and task performance is directly related to task performance, as it involves knowing how to perform a task or skill. When having a strong understanding of procedural knowledge, individuals can perform tasks more efficiently and effectively, leading to increased productivity.

2.9 Cognitive Load and Productive Skills

Baddeley (1983) found that working memory as "The temporary storage of information in connection with the performance of other cognitive tasks such as reading, problem-solving or learning" (1983: 311). There is a clear connection between students' development in language learning in speaking (the length of pronounced statements) and cognitive load . If a student can produce a long utterance, it shows the language competency. The length of utterance is a good marker in showing the number of the words or morphemes in each produced statement of their spontaneous utterances (Ranti, 2015: 23). When students are ready to embark on lengthier writing, where the cognitive load is even greater, they need to learn to construct clear, linear outlines that enable them to organize their thoughts, avoid repetition, and stay on track. Juggling those tasks in working memory while writing can be overwhelming even for many experienced writers. Once students have used an outline to create a draft, they can use their pre-existing knowledge of sentence-level strategies to vary their sentence structure and create smooth transitions (Judith &Wexler, 2017:34).Cognitive load theory suggests that learning is hampered when working memory capacity is exceeded in a learning task. However, not all cognitive load is detrimental to better thinking and learning.

3. Procedures

3.1 Population and Sampling

Creswell (2012:142) describes population as "a group of individuals who have the same characteristic. For example, all teachers would make up the population of teachers, and all high school administrators in a school district would comprise the population of administrators. The population in the present study is 1050 which are the whole students of the English Department , College of Education for Humanities at Tikrit University on the academic year 2022-2023. According to Ary, Jacobs, & Razavieh (2010: 148), a sample is a number of individuals, objects or events selected for a study from a population, usually in such a way that they represent the large group from which they are

selected. The sample of the present study was (240) third-year college students (male and female) of the academic year 2022-2023**.**

.32 The Study Instruments

Creswell (2012: 355) notes that correlation research requires the researcher to collect two datasets from each individual. According to that, the researcher uses two instruments: a questionnaire and two diagnostic tests as tools for collecting the data of the study. The questionnaire is used to collect data of students' cognitive load types, while one of the tests is to gather information about the students' procedural knowledge and level of cognitive load with writing skills of English language for college students , and the second test is used to gather data of procedural knowledge and level of cognitive load of college students with speaking skills.

3.2.1 A Diagnostic Writing Test

Creating a writing diagnostic test to measure procedural knowledge PK, cognitive load level CL and writing skills of (EFL) students requires careful planning and consideration of the learning objectives and skills that researcher wants to assess. The test includes Four Questions: **Question one**: Compare and Contrast two Paragraphs. In this task, researcher gives two paragraphs, one about Pablo Picasso and the other about Ernest Hemingway. The task is to find and write about the similarities and differences. **Question two :** Write a Fact File on Wildlife, for this task, the researcher asks to create a fact file about wildlife, with a specific focus on a place, an example of wildlife, the types of plants present, and the animals in that environment. **Question three**: Write a Short Essay Based on a Picture . **Question four:** Reflect on Your Academy Life . For this task, researcher asks to reflect students on their own academic experiences and write about their academy life.

3.2.2 A Diagnostic Speaking Test

A diagnostic test of speaking skills to measure procedural knowledge PK, level of cognitive load CL and speaking skills of (EFL) students require careful planning and consideration of the learning objectives and skills that researcher wants to assess. Performance objectives in this test are specific to measure PK, CL, and speaking skills. The test includes Four Question: **Question one:** summarize a paragraph on Globalization, in this task, the students are given a paragraph about globalization. They have to read the paragraph and then provide a concise summary of its main ideas orally. **Question two:** provide two ideas on the impact of Technology on Society. For

this task, students are asked to give two ideas, positive and negative one orally. **Question three**: Describe a picture, in this task, students will be presented with a picture, and their job is to describe what they see in the picture orally. **Question four**: Speak about your Neighbor based on the example passage that are given about (Friendship). For this task, students are given a passage that discusses the importance of friendship and close relationships.

3.2.3 The Questionnaire

According to Nunan & David (1992:231), questionnaires are instruments used to collect data usually in written form. Consisting of open and/or closed questions, probes, and other questions that call for responses from subjects. The researcher uses a questionnaire to measure the levels of the three types of cognitive load of students' performance in speaking and writing tests. A multidimensional questionnaire was adapted with some modification from Leppink et al. (2013) to ask the learners to rate their perceived mental effort they have use through responding to the two diagnostics tests, on Likert a 5-point scale ranging from strongly disagree, disagree, neutral, agree, strongly agree. the perceived mental effort is an indicator of the cognitive load types caused by understanding the task.

The questionnaire consists of fifteen items measuring each type of cognitive load, some of items are positive and others are negative. The items of the questionnaire are concerning the complexity of questions of the two tests and tasks of tests . If the analyzing results of the questionnaire show a higher complexity of test's questions, this means the higher the intrinsic cognitive load ICL, and this assessed through the first five items of the questionnaire in the first domain. The second five items should be assessed extraneous cognitive load ECL that the items refer to the question instruction’s clearness and effectiveness. For example, unclear language would therefore increase extraneous load. The third five items in third domain would assessed germane cognitive load GCL that the items focus on the learners’ understanding of the formulas, concepts, and tasks of the test.

3.3 Face Validity of the Instruments

An important facet of consequential validity is the extent to which "students view the assessment as fair, relevant, and useful for improving learning" (Gronlund,1998:210). To insure the test validity, it has been submitted to a jury specialists in the English language teaching methodology and Linguistics. The jurors have been asked to decide the face validity of the study

instruments , and the suitability of the scoring schemes used in scoring the instruments.

3.4 Content Validity of Diagnostic Tests

Weir (2005:25) refers to content validity as the process of determining how thoroughly test tasks are being evaluated. In other words, content validity is a thorough examination of the test content to determine whether it accurately reflects the subject matter and the behaviors that are intended to be measured.

3.5 Item Discrimination Index of Questionnaire

Item discrimination index is the degree to which the results of the individual item correspond with the results of the whole scale (Alderson et al., 1999). The computed t- value of all items is higher than the critical one (1.98) at a degree of freedom (58) and a level of significance (0.05) , which indicates that all the items are statistically significant .

3.6 Reliability of the Diagnostic Tests

To achieve the aim, Thus, the same dignostic test has been administered to the pilot sample of (60) students. Chronbach's Alpha, which statistically measures the internal consistency, has been used to find the reliability of the dignostic test. Chronbach's coefficient writing test is 0.84 and the speaking test is 0.81 which indicates that the test is very highly reliable.

3.7 Reliability of the Questionnaire

According to Cohen, Manion, & Morrison (2007:506) the reliability of the questionnaire can be calculated by using Cronbach's Alpha formula, which is a formula used to measure internal accuracy statistically. It tests how closely a group of items is associated with each other. Cronbach's Coefficient value varies from(0)to(1). the Cronbach's Alpha value , it is showing that ICL is 0.83 , Alpha value for ECL is 0.92, and GCL is 0.86, we can assume that the reliability of the questionnaire is highly reliable.

4.1 Data Analysis and The Results

4.1.1 Result Related to the first Question

To analyze the data related to the first question namely: **What is the type of correlation between students' procedural knowledge and their performance in productive skills?** , the correlation formula has been used.

Consequently, the first aim of the study undoubtedly: **(Finding out the relation between procedural knowledge and performance of productive skills for Iraqi EFL university students)**, will be achieved . In order to find whether there is a significant correlation between the students' level in procedural knowledge and productive skills**,** is investigated by using Pearson's product moment coefficient of correlation. It is one of the most well-known association measures which has a statistical value ranging from 1.0 to +1.0 and expresses this relationship quantitatively. The coefficient will also be denoted by the sign r (Cohen et al,2007:530). The data is gathered by means of diagnostics tests. The Pearson Product Moment Correlation Coefficient Formula is used by the researcher with in the SPSS version 26 program to measure the correlation between the procedural knowledge and writing and speaking skills of EFL university students.

For achieving this aim, diagnostic tests are applied for (180) students to measure the correlation between procedural knowledge and productive skills. Productive skills includes writing and speaking:

A. Correlation between Students' Procedural Knowledge and their Performance in Writing Skill

The findings are displayed in table (4.1) show the correlation between students' procedural knowledge and their performance in writing skill.

Table (4.1)

Correlation between Students' PK and Writing Skill

		Procedural Knowledge	**Writing skill**
procedural knowledge	**Correlation**	1	0.815**
	Significance(2-tailed)		0.000
	N	180	180
	Correlation	0.815**	1
	Significance (2-tailed)	0.000	
	N	180	180
****. Correlation is significant at the 0.01 level (2-tailed).**			

The calculation above shows the correlation coefficient is 0.815, the sig (2-tailed) value 0.00 is lower than level of significant (α) 0.05 and the correlation coefficient 0.815 is higher than level of significant (α) 0.05. It can also be interpreted according to its r table with df = 178, the coefficient of r table is 0.195 .Thus, r count 0.815 is higher than r table 0.195. After calculating the r (correlation coefficient), the t-test is used to determine how significant the correlation between the procedural knowledge and writing skills at Tikrit university College of Education for Humanities in the academic year 2022-2023. The t-table value of the degree of freedom (df) = 178 with (0.05) level of Significance is (1.9674). Thus, the obtained t value is higher than the t-table value (16.994 > 1.9674). there is a significant correlation between students' procedural knowledge and writing skill and that the correlation is positive since the coefficient of 0.815 is (+).The coefficient 0.815 is classified as a high.

B. Correlation between Students' Procedural Knowledge and their Performance in Speaking Skills

The findings are displayed in table (4.2) show the correlation between students' procedural knowledge and their performance in speaking skills.

Table (4.2)

Correlation between Students' PL and Speaking Skills

		procedural knowledge	**Speaking skill**
procedural knowledge	**Correlation**	1	0.071
	Significance(2-tailed)		0.393
	N	180	180
	Correlation	0.071	1
	Significance (2-tailed)	0.393	
	N	180	180
****. Correlation is significant at the 0.01 level (2-tailed).**			

The calculation above shows the correlation coefficient of 0.071, the sig (2-tailed) value 0.393 is higher than level of significant (α) 0.05 and the correlation coefficient 0.071 is higher than level of significant (α) 0.05. It can also be interpreted according to its r table with df = 178, the coefficient of r table is 0.195 .Thus, r count 0.410 is higher than r table 0.195. After calculating the r (correlation coefficient), the t-test is used to determine how significant the correlation of between the between PK and speaking skills at Tikrit university College of Education for Humanities in the academic year 2022-2023. The t-table value of the degree of freedom (df) = 178 with (0.05) level of Significance is (1.9674). Thus, the obtained t value is higher than the t-table value (4.226 > 1.9674). there is no significant correlation between students' procedural knowledge and speaking skills.

4.1.2 Result Related to the Second Question

To analyze the data related to the second question namely: **What is the type of correlation between students' cognitive load and their performance in productive skills?,** the correlation formula has been used. Consequently, the second aim of the study undoubtedly: (**Finding out the relation between cognitive load and performance of productive skills for Iraqi EFL university students)**, will be achieved . The data is gathered by means of diagnostic tests. The Pearson Product Moment Correlation Coefficient Formula is used by the researcher with in the SPSS version 26 program to measure the correlation between the procedural knowledge and writing skill of EFL university students. For achieving this aim, diagnostic tests are applied for (180) students to measure the correlation between cognitive load and productive skills. Productive skills includes writing and speaking skills:

A. Correlation between Students' Cognitive Load and their Performance in Writing Skills

The findings are displayed in table (4.3) show the correlation between students' CL and their performance in writing skill

Table (4.3)

Correlation between Students' CL and Writing Skill

		Cognitive Load	**Writing skill**
procedural knowledge	Correlation	1	8.847**
	Significance(2-tailed)		8.000
	N	180	180
	Correlation	8.847**	1
	Significance (2-tailed)	8.000	
	N	180	180
****. Correlation is significant at the 0.01 level (2-tailed).**			

The calculation above shows the correlation coefficient is 0.847, the sig (2-tailed) value 0.00 is lower than level of significant (α) 0.05 and the correlation coefficient 0.847 is higher than level of significant (α) 0.05. It can also be interpreted according to its r table with df = 178, the coefficient of r table is 0.195 .Thus, r count 0.847 is higher than r table 0.195. After calculating the r (correlation coefficient), the t-test is used to determine how significant the correlation between CL and writing skills at Tikrit university College of Education for Humanities in the academic year 2022-2023. The t-table value of the degree of freedom (df) = 178 with (0.05) level of Significance is (1.9674). Thus, the obtained t value is higher than the t-table value (19.252> 1.9674). there is a significant correlation between students' CL and writing skill and that the correlation is positive since the coefficient of 0.847 is (+). The coefficient 0.847 is classified as a moderate. The results show that there is statistically significant relationship between students' CL and writing skill, as (sig) 0.000 < (α) 0.05.

B. Correlation between Students' CL and their Performance in Speaking Skills

The findings are displayed in table (4.4) show the correlation between students' CL and their performance in speaking skills.

Table (4.4)

Correlation between Students' CL and Speaking skill

		Cognitive Load	Speaking skill
procedural knowledge	**Correlation**	1	0.831**
	Significance(2-tailed)		0.000
	N	180	180
	Correlation	0.831**	1
	Significance (2-tailed)	0.000	
	N	180	180
****. Correlation is significant at the 0.01 level (2-tailed).**			

The calculation above shows the correlation coefficient of 0.410, the sig (2-tailed) value 0.000 is lower than level of significant (α) 0.05 and the correlation coefficient 0.831 is higher than level of significant (α) 0.05. It can also be interpreted according to its r table with df = 178, the coefficient of r table is 0.195 .Thus, r count 0.931 is higher than r table 0.195. After calculating the r (correlation coefficient), the t-test is used to determine how significant the correlation of between the between CL and speaking skill at Tikrit university College of Education for Humanities in the academic year 2022-2023. The t-table value of the degree of freedom (df) = 178 with (0.05) level of Significance is (1.9674). Thus, the obtained t value is higher than the t-table value (18.050 > 1.9674). there is a significant correlation between students' CL and speaking skills and that the correlation is positive since the coefficient of 0.831 is (+). The coefficient 0.831 is classified as a high. The results show that there is statistically significant relationship between students' CL and speaking skills, as (sig) 0.000 < (α) 0.05.

4.2 Discussion of the Results

Results of first aim show that, there is a significant correlation between students' procedural knowledge and writing skill and that the correlation is positive. And the results of the fourth aim show also, that there is no significant correlation between students' procedural knowledge and

speaking skills. While the results of second aim show that There is a significant correlation between students' CL and writing skill and that the correlation is positive. Moreover there is a significant correlation between students' CL and speaking skill and that the correlation is positive also.

5.1 Conclusion

According to the obtained results of the current study, have been concluded that the level of the EFL university students in procedural knowledge is above the average level. And the level of the EFL university students in cognitive load is above the average level. Students response in Germane Cognitive Load has the highest mean score. There is a significant correlation between students' procedural knowledge and writing skill and that the correlation is positive.There is no significant correlation between students' procedural knowledge and speaking skill , and there is a significant correlation between students' CL and writing skill and that the correlation is positive

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