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**An ESP Program Based on Cognitive Academic Language
Learning Approach for Enhancing Academic Reading and
Technical Writing Skills among Microbiology and
Biochemistry Students**

BY

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ABSTRACT

This study investigated the effectiveness of using An ESP program based on Cognitive Academic Language Learning Approach (CALLA) in developing academic reading and technical writing among Microbiology and Biochemistry first year students at the Faculty of Science, Obourr Campus, Benha University. The study followed a pre-post experimental one group design. The participants were 37 students. The researcher used a needs analysis questionnaire to determine their academic needs. Moreover, the results of the questionnaire indicted their needs to academic reading and technical writing skills. The researcher designed academic reading test and technical writing test. Students were pre-tested, to identify their entry level of academic reading and technical writing skills .Then; they were trained through the ESP CALLA- based program on how to develop their academic reading and technical writing skills. The post-test was applied to the participants to assess the progress in their level of performance in academic reading and technical writing skills. Findings of the study revealed that there was statistically a significant difference at 0.01 in the pre- and post-assessment of academic reading and technical writing skills in favour of the post-assessment. Therefore, the ESP program that based on CALLA was effective in enhancing academic reading and technical writing skills.

Key words: *ESP program-, CALLA based program- academic reading skills- technical writing skills-Microbiology and Biochemistry students*

برنامج فى اللغة الإنجليزية للأغراض الخاصة قائم على المدخل المعرفى الأكاديمى لتعلم اللغة (CALLA) لتنمية مهارات القراءة الأكاديمية والكتابة الفنية لدى طلاب الميكروبيولوجى والكيمياء الحيوية إعداد

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المستخلص:

تهدف الدراسة الحالية الى التحقق من مدى فاعلية استخدام برنامج فى اللغة الإنجليزية للأغراض الخاصة قائم على المدخل المعرفى الأكاديمى لتعلم اللغة لتنمية مهارات القراءة الأكاديمية ومهارات الكتابة الفنية لدى طلاب الفرقة الأولى ببرنامج الميكروبيولوجى والكيمياء الحيوية بكلية العلوم بفرع جامعة بنها بالعبور. استخدمت الدراسة التصميم التجريبي للمجموعة الواحدة القياس القبلي- بعدى لعينة الدراسة والتي بلغ قوامها سبعة وثلاثون طالب وطالبة. تم تحديد احتياجات الطلاب من خلال قيام الباحثة بتطبيق استبيان الاحتياجات الاكاديمية والذي أكدت نتائجه على احتياج الطلاب لمهارات القراءة الأكاديمية والكتابة الفنية. قامت الباحثة بإعداد اختبار فى مهارات القراءة الأكاديمية واختبار فى مهارات الكتابة الفنية . قامت الباحثة بتطبيق الأختبارات قبليا لتحديد مستوى الطلاب فى القراءة الأكاديمية والكتابة الفنية. تلقت عينة الدراسة تدريبا من خلال تطبيق جلسات البرنامج القائم على مدخل المعرفى الأكاديمى لتعلم اللغة خلال الفصل الدراسي الأول من العام الجامعى 2021/2020 . تم تطبيق اختبارات القراءة الأكاديمية والكتابة الفنية بعديا لتحديد مدى التقدم فى مستوى الطلاب . أشارت نتائج الدراسة إلى وجود فروق ذات دلالة احصائية عند مستوى دلالة 0.01 بين متوسطى درجات الطلاب فى التطبيق القبلي والبعدى لاختبار القراءة الاكاديمية واختبار الكتابة الفنية وذلك لصالح التطبيق البعدى. وتؤكد هذه النتائج على مدى فاعلية استخدام برنامج فى اللغة الإنجليزية للأغراض الخاصة القائم على المدخل المعرفى الأكاديمى لتعلم اللغة فى تنمية مهارات القراءة الأكاديمية والكتابة الفنية .

الكلمات المفتاحية: برنامج فى اللغة الإنجليزية للأغراض الخاصة- برنامج قائم على المدخل المعرفى الأكاديمى لتعلم اللغة- القراءة الأكاديمية - مهارات الكتابة الفنية- طلاب برنامج الميكروبيولوجى والكيمياء الحيوية.

1-Introduction

English for Academic Purpose (EAP) origins dated back to 1960s as a branch of English Language Teaching (ELT) namely as “English for Specific Purposes” (ESP). There was a great development in ESP influenced by the new language acquisition theories. It is basically directed to qualify learners with specific skills related to what they study or their specifications. ESP Researchers should focus on needs analysis and genre analysis, so it can be said that its main concern is specific needs to a very specific learners (Bankowski,2010; Otilia &Brancusi,2015 and Ramirez,2015; Besahj, 2014)

For the Science students in general and the biochemistry in particular, the desired skills fall into the next broad categorizations: communication; proficiency; information technology; problem-solving; working with others; improving own learning and performance (Murphy 2001, Tariq & Cochrane 2003). These classifications contain basic skills such as facts gathering, critical thinking and time management. Students should become active learners, with the motivation to boost their ability to work individually and be self-critical, but they also need to be effective in interactions with others (Rosenberg et al. 2012). Subject-specific skills concern with the scientific process, and comprise manipulating a research project, investigation and explanation of results and communicating in a way suitable for a specific addressees, such as in Writing a scientific abstract as a part of technical writing skills.

Academic reading is important for bioscience students as it contains specialist materials with challenging vocabulary that is too difficult for learners to grasp its meaning in a very short time. So, it can be said that academic reading does not mean finding information in the text, but it is a process of exerting extra effort within the text to recreate the meaning and get the author’s intended meaning (Hermida, 2009).

There are several strategies and approaches used to develop learners’ academic reading skills and technical writing such as Cognitive Academic Language Learning Approach (CALLA). CALLA’s framework is based on cognitive theory of learning. This theory focused on how people learn and how human brain works to grasp any new information or material and respond to it. In order to understand the new material, one’s mind has to use cognitive processes. Learning, according

to this theory is an active process in which learners select information, organize, relate it to their prior knowledge and use the new information to reflect on the outcomes of the learning process. These processes indicated that learners will learn things best when they build new knowledge based on the prior one (Atherton, 2011 & Gibson, 2007).

2-Literature Review

2.1-Academic Reading:

Academic reading represents a vital role in EAP field, as readers need to develop their academic English and reading skills through using direct instruction form. As a result, the main goal of EAP course is to provide students with adequate reading strategies that enhance their success in academic courses as their specifications require them to read different materials in various fields of knowledge to accomplish specific tasks (Cohen, Kirschner & Wexler, 2001). In the same vein, Kuzborska,(2011) asserted that academic reading instruction should be based on a comprehensive and well-structured needs analysis of students . Instructors use these needs to form specific training course based on their genres and topics which students need to enhance and achieve their success and course specifications. So that, academic reading is not an activity that students practice to read only sentences and words, but they need to identify the intended meaning of these words and sentences to be effective reader (Prasetyo,2020;Khemlani & Lynne,2000).

Academic reading skills involve the reader first to identify the meaning of words and grammatical structures to comprehend and interpret the text (Silberstein, 1994). This means that the reader should focus first on the bottom-up and then top-down processes of reading skill. Bottom-up processes comprise lexical access, syntactic parsing, and semantic proposition formation, and working memory activation (Grabe & Stoller, 2002) Then, the top-down includes the whole meaning of the reading text. The central functions of academic reading are the following: to pursuit for simple facts, to skim the reading text rapidly, to integrate information, to evaluate texts, and for overall comprehension. Students should be sensible of what to assume from academic reading texts. Success in academic reading depends on some signs; it is influenced by at least three features: reader characteristics, the attributes

of the texts, and the request of the reading task assured in sociocultural context (Snow, 2010).

The reader within academic reading materials needs to understand the automatic word recognition. This gives him the ability to create the meaning of the text in an interactive process (Hellekjaer, 2009). Consequently, academic reading as a process contains three central phases: before reading, during reading and after reading phase. In the before reading phase, the learner should evaluate the task to apprehend the meaning of the author or to predict his intentions. In the second phase (performance phase or during reading phase), the reader should apply precise strategies that display his comprehension of the text. Finally, he reaches to the last phase (after reading or self-reflection phase), within this phase the learners become more aware of information within the texts as a whole and have a great control over the text (Wolley, 2011).

There are numerous classifications of academic reading skills. Alyousef, (2005); Dubin, Eskey & Saviganon, (1986) and Grabe (1991) categorized academic reading skills into perception or recognition skills, that means the reader should differentiate between different types of reading materials even in charts, tables, or graphs to find specific information quickly. Moreover, vocabulary is a very important aspect of academic reading skills, through which the reader can deduct the meaning of unknown words to get the overall meaning of the reading material. The reader should also have the ability to identify the different syntactic patterns of the language and cohesion or the transition forms within the text. Finally, the reader should be able to determine the author's stance or goals and critique any reading material.

Mohan (1990) and Jordan (1997) have classified reading skills and sub-skills for EAP. They mentioned that readers need basic academic reading skills such as prediction, skimming, and scanning. In addition, distinguishing between factual and non-factual information, explicit and implicit information, drawing inferences and deducing unknown words to comprehend texts is very urgent for them. Moreover, students in EAP courses need to practice skills like understanding graphic presentations and interpret its data or even to read diagrams

correctly. In addition to, understanding text organization and semantic aspects; sentences function is very important sub-skills and have a great effect on learners' comprehension of academic reading materials.

There are several strategies and approaches that have been used in literature to develop academic reading skills. Eid (2008) in her study aimed to investigate the effect of using internet-based instruction in the development of academic reading and writing skills of post graduate students in the faculties where English is used as a medium for instruction and research writing such as medicine. The results indicated the effectiveness of the internet-based instruction in developing the participants' academic reading and writing skills. Radwan (2017) aimed to develop academic reading skills and attitudes towards it among first year engineering students through using the deep approach. The study had two main instruments: academic reading test and an attitude towards reading questionnaire. The results indicted the effectiveness of using the deep approach in developing academic reading and their attitudes towards it. The researcher also, recommended that the deep approach should be integrated as a part of any academic reading instructional program.

2.2-Technical Writing

Writing skills are intensely improved when instruction is explicitly deliberated to satisfy students' needs. Writing is one of the essential devices for individuals to express themselves, to form ideas, to convince and assure others (Gracey, 2004). There has been an increasing concern to teach writing since it is a useful tool for learning (Abolyosr, 1996). Moreover, as a complex process it contains various cognitive strategies, so that there are many problems stir up from unenthusiastic students when instructors decide to practice it within a course. (Yalvac, Smith, Troy and Hirsc ,2007). Therefore, an English instructor as the organizer in teaching writing process should design a good instruction to stimulate students to write a good writing for instance, media and technique used in teaching writing instruction should be related to student experience and the effects they see in their environments (He &Shi, 2012)

Technical writing is defined as the act of communicating information, strategies in a scientific fields (Yu,2007). It conveys

specific information about technical subject to specific audience for a specific purpose .The writer in it does not need inspiration, he/she only needs motivation, logical thinking and a lot of practice (Estrin& Elliot 1990& Nicron,2006).It comprises many types of documents such writing reports, technical papers and writing scientific instructions or even operational manuals Moreover, the technical documents should contain unambiguous language, graphics with varied formats and headings or action titles (Buldinski,2001; Estrin, & Elliot, 1990).

There is a great difference between the technical writing and the academic writing. The goal of technical writing is to document and confirm achievements; review certain processes (Gerson & Gerson, 2006). Technical writing is read by various readers or audiences, whereas academic writing satisfies only one person, the teacher. Moreover, the technical writing is conducted by an informed writer according to his specification to deliver definite information to an informed reader, whereas academic writing is done by a student or learner to a teacher. As a result, the most evident features of technical writing are as follows: It has a purpose, convers facts, impersonal, concise and cites the contributions of others (Budinski, 2001& Busch-Lauer, 2002 and Pfeiffer, 1994)

There are specific criteria for good technical writing such as: accuracy, appropriateness, clarity, well-structured and well-organized. Accuracy means the text should contain correct technical information. Appropriateness means the correct tone and style that the document should be written in a correct tone and in a clear and concise style and to be unbiased and write in an objective tone. The technical writer should write in a positive style and in an active voice not passive and avoid unfamiliar technical words or even euphemisms or words in contemporary meanings that differ from the dictionary meaning. Ideas within the document should be grouped in an organized flow of thoughts with a correct grammatical structure and contain all the data that reader may require to acquire the meaning of the text (Jayaprakash,2008).

Gerson and Gerson (2006) asserted that technical writing has three main steps: The pre-writing, during writing and the rewriting process. In the pre-writing process, the technical writer has to prepare for his project or how to document specific information, examine his purpose, gather his data, and consider his audience and to think in a precise way to determine

how the content will be provided. There are many techniques for this stage such as: brainstorming or outline that enables the writer to place his ideas in the write positions. Moreover, (Woolston, Robinson & Kutzbach, 1988) asserted that in the second stage of technical writing (during writing), the technical writer has to organize his technical report in a systematic sequence and in a comprehensive way, so that the reader can follow. Moreover, he should format the content to be accessed easily. In the last stage of technical writing process (rewriting), the writer comes to revise what he wrote and has to proofread the document and edit it whenever possible (Rhodes, 2005). Within this stage, the writer can revise spelling and technical details for any errors in measures or formulas. In the editing phase, the editor can check the completeness and the appropriateness of the language to get the final reliable structure of the document that has the feature of flow and clarity in organization (Corbin, Moell, & Boyd, 2002).

Jayaprakash (2008) asserted that good technical writer should have three main qualities such as: basic skills, personal skills and essential skills. The basic skills contain some indicators for instance the language skills, writing skills, technical competency and being specific and concern for consistency. The personal skills represent the reasoning and problem solving, handling stress and having communication skills. The last main skills are the essential skills that technical writer needs such as creative thinking, project management and time management. It can be concluded that as technical writers, students need to organize their reports previously and elaborate their ideas before handling writing. Brainstorming their ideas is a good technique, as well as reading other technical booklets in advance. It is vital to inspire engineering students and science students to improve their reading habit, as they often struggle to precise their ideas as a result of their deficiency of vocabulary. This can be a major barrier for engineering and science students (Vesilind, 2007).

Science students in general and Chemistry and biochemistry students in particular need to develop their technical writing skills that are called formal journal style or lab reports. Developing these skills is an essential aim, as students are not given sufficient time to analyze and reread their writing. Additionally, they are rarely taught how to review or write through systematic steps. In the same vein, Gragson, & Hagen, (2010) in their research have suggested an approach to help students

develop their technical writing skill that used the peer-review process and comprises comprehensive guidance for writing reports in a progressive style. They presented some tasks to assess students' progress in technical writing skills.

There are various strategies and approaches used to develop students' technical writing skills. Chaisuriya (2003) investigated the effect of using social constructivist approach to teach technical writing skills. The study sample consisted of 30 sophomore science major students. The researcher used various strategies such as collaborative writing, writing as a process and peer-review methods. The findings indicated the effectiveness of the social constructivist approach in developing technical writing skills. Moreover, Jensen and Fischer (2005) used the peer evaluation in teaching technical writing. The results indicated that the treatment was effective in developing study sample' report technical writing skills.

Zaki (2009) used an ESP program to develop technical writing skills among second year faculty of engineering students. The sessions of the program focused on developing technical writing functions and style. The researcher used collaborative activities and peer-review technique. The results indicated that the technical writing was important for the study sample in both academic requirements and the success in workplace. Head (2012) used wiki to develop technical writing skills among graduate students. Participants used wiki to share their research objectives and conclusion in a clear manner. The researcher used feedback activities to assess the quality and clarity of the participants' technical writing. Results of the study indicated the significant effect of using wiki in developing technical writing skills.

Other researchers such as Stephenson, Miller & Sadler-Mcknight (2019) used two main approaches: peer-led team learning and Science writing workshop template to develop critical thinking and technical writing skills among first year chemistry students. The researchers used a quasi-experimental pre-test post-test design to detect the effect of implementation. The results indicated the significant effect of the two approaches in developing technical writing among science students and critical thinking skills. Samarasekara, Dulani; Mlsna, Todd; Mlsna and Deb (2020) conducted a study on students in an upper-division Environmental Chemistry course used peer review and response to reviewer comments to improve their technical writing skills. The

researchers used editing peer papers and mimic the peer-review process required for scientific publication. The Response to Reviewer Comments document was planned to have students think critically about their writing and support their choices with respect to peer edits. Results indicated that student writing assignments' were improved with this process; however, they need extra maintenance to develop their critical think about their own writing.

2.3-Cognitive Academic Language Learning Approach (CALLA)

CALLA is a comprehensible instruction for English language learners which incorporated three important basics in learning theory specifically language improvement, content area tutoring and explicit instruction in learning strategies (Chamot and O'Malley, 1994). CALLA approach is suitable for all English learners with insufficient English ability to develop their academic skills. Consequently, CALLA is proposed for apprentices at the intermediate and advanced levels of English proficiency who need supplementary practices in English language development definitely related to three academic areas: science, mathematics, and social studies (Chamot and O'Malley, 1987).

CALLA is used to develop English language skills (listening, speaking, reading and writing). Its main concern is the learner's prior knowledge, cultural and linguistic knowledge. The second step is to practice interactive teaching and learning. It helps apprentices to focus on learning processes and strategies to enable learners evaluate their learning. Therefore, through CALLA students become more motivated in the learning process and language practice and more self-regulated students. Apprentices through this approach can plan, control and direct their mental processes through accomplishing activities or tasks in their learning environment (Montalvo&Torres,2004).

There are three main components of CALLA: Content-based curriculum, English language development and learning strategies. CALLA is considered as content-based as instructors can use it to develop their learners' academic language. Teachers can choose concepts, facts or topics and use additional support such as demonstration or hands-on activities to stimulate their learners to remember the concept presented (Chamot,2007). The second component of CALLA is the language development as it is used in practicing

language functions such as explaining, describing and understanding the discourse features and can be applied in the four language skills. The third feature of the approach is the learning strategy instruction, through which students can use sensible processes to facilitate their comprehension of the new materials and monitor their own progress. (Chamot and O'Malley, 1994; Chamot, 2005). By applying the three elements, students became more independent and strategic learners and have the opportunities to take a dynamic role in their own learning. (Reed and Railback ,2003).

O'malley & Chamot (2013) suggested five main phases of CALLA in the classroom. Preparation phase is the first phase, in which the instructor provides orientation and brainstorming to encourage students to use their prior knowledge to acquire the new concepts or vocabulary (Peyton, 2000). Instructors used some various strategies such as selective attention and advance organizers. Through this stage, apprentices can use certain activities as questionnaires, class-discussion, diaries and group or individual interviews in which students define and share their distinct techniques for finishing a task efficiently. The purpose of this phase was to help students categorize the strategies they are already using and to enhance their metacognitive awareness of the relationship between their own mental processes and actual learning.

The second phase of CALLA is the presentation phase. The focus in this stage is on assigning new information to apprentices through using new strategies. The new information must be presented in a meaningful and visual way to be easy accessed by students. The instructor named, described and modeled the strategy by using think-aloud protocol. Through adopting thinking-aloud protocol, students can think more precisely and in a systematic way. Thus, modeling empowers learners to be independent and autonomous learners. There are numerous strategies that instructors can apply in this phase such as: selective attention, self-monitoring, differencing and note-taking strategies (Anderson, 2005; Chamot & Robins, 2006; Harris & Gaspar, 2001 and Macaro,2002).

Practice is the third stage of CALLA. It is a mainly learner-centered as students engaged in hands-on activities to rehearsal new information. Cooperative learning is effective in this process as students can work together to practice the new strategies (Djiwandno,2006& Nunan,2002).Through this phase, the instructor encouraged his students

to use strategies such as grouping, imagery, deduction and questioning for clarification and planning how to develop an oral or written composition(Omalley&Chamot,1990).The main concern of this stage is to practice the new strategies rather than getting correct answers. The instructor acts as a facilitator, coach or monitor who provides students with immediate feedback (Dornyei,2005).

The fourth phase of CALLA is the evaluation phase. At this stage students have the opportunities to evaluate their success and proficiency with language strategies they practiced. Through this stage, students have the ability to develop their metacognitive awareness. The learning strategies that practiced through this stage are: self-evaluation; asking for clarification and elaboration (Chamot &Robbins, 2006). It can be concluded that at this stage, students can reflect on their individual learning and plan to remedy any deficits (Cohen, 2008). Activities through this stage include class-discussion, learning logs, diaries and charts that can be conducted even individually, cooperatively or teacher-directed (Bueh, 2009)

The last phase of CALLA is the expansion phase. Moving to this stage, students would have the ability to apply what they have learned to new tasks and to use the strategy in a new way or context. Teacher's role in this phase is to encourage students to apply the new strategies on their own. Transferring the strategy to a new context is a pre-requisite in this stge. Instructor also, helps his students through giving positive feedback to monitor their progress and enable them to use it in a new learning context. Diaries are important classroom activities that learners can use in this stage as they become more encouraged and can expand what they have learned to a new learning situation (Willis,2007;Chamot et al.,2004).

CALLA has been used to develop English language learners' reading and writing skills. Olson and Land's (2007) tried to develop secondary stage students reading and writing skills. The study participants received comprehensive cognitive strategies through the program sessions. The results indicated the effectiveness of CALLA in developing the participants' reading and writing skills. In another study conduct by Takallou (2011), examined the effect of metacognitive strategies that based on CALLA in developing reading comprehension and cognitive awareness of the study sample. The results indicated that

the experimental group outperformed the control one in their post assessment of reading comprehension and cognitive awareness.

2.4-CALLA and Reading skills:

Several researchers recommended using CALLA in developing academic reading skills. Shih(1992), recommended that EAP programs should use a more holistic and strategy-oriented approach to develop academic reading skills such as CALLA. She asked the researchers to use CALLA to prepare students even in the intermediate or advanced level to meet the demands of the postsecondary content classes. She urged researchers to use CALLA strategies even cognitive or metacognitive for achieving the desired learning outcomes. Hamifah & Afidah (2018) aimed in their research to develop a reading text book for first year of Shariah economy students. They used CALLA and its strategies to develop the textbook's units. The book consisted of eight units adapting various strategies such as skimming, scanning, activating schemata and semantic mapping.

Babiker, Elsheikh, Alhassan, & Khalaf (2016) aimed in their study to assess the effect of a training program based on Meta-Cognitive strategies (MCS) of CALLA approach on lexical knowledge and critical reading skills. The core findings of this study are that; there is a statistically significant correlation between the use of MCS of CALLA and students mastering of reading skills and lexical knowledge.

Ajideh, Zohrabi, & Pournalvar, (2018) investigated the effect of explicit instruction of metacognitive reading strategies on ESP reading comprehension among university students. The participants in this study included undergraduate first and second year students studying Islamic Art and Architecture Engineering at Tabriz Islamic Art University, Iran. The study sample in the experimental groups received explicit instruction of metacognitive reading strategies through the Cognitive Academic Language Learning Approach (CALLA). The results of the study indicated the enhancement of ESP reading comprehension skills.

In a recent study conducted by Rifidi(2020) examined the effectiveness of CALLA in developing Palestinian university students' reading skills and satisfaction towards English . The results indicted the effectiveness of CALLA in developing participants' reading

comprehension and satisfaction towards English language. Moreover, Rahman (2020) used metacognitive strategies of CALLA for developing academic reading skills of Indonesian university students. The researcher used this treatment to enhance participants' academic reading skills and reading schemata. The results indicated the importance of CALLA strategies for developing academic reading purposes.

2.5-CALLA and Technical writing:

Martisa (2013) conducted a study to develop senior high school students' writing quality through using CALLA. The students were assessed in the following aspects of writing: content, organization, vocabulary, language use and mechanics. It is concluded that CALLA was effective in developing students' writing quality. Mansour, Talafhah, Aljarrah and Alshorman, (2018) aimed to investigate the effect of using CALLA based instruction on Almazra secondary school students' writing achievement. The researchers recommended the usage of CALLA as a teaching approach in Jordanian English classes and hoped to use it in improving English language communication skills.

Yufrizal, (2019) investigated the effect of Cognitive Academic Language Learning Approach in improving students' English writing ability and its effect on their writing performance. The participants of the study were senior high schools students in Indonesia that was divided into two groups: experimental group and control group. The results showed that students improved their writing after they were involved in Cognitive Academic Language Learning Activities. Abdrabo (2020) conducted a study to develop some writing skills among second year preparatory stage pupils using CALLA. The instruments of the study included a writing checklist, writing test and a rubric for scoring the test. The results indicated the effectiveness of CALLA in developing writing skills. In a recent study conducted by Sakkir, Dollah, Arsyad & Ahmed (2021) developed students technical writing processes using social media face book. They designed a face book-based writing instructional course. The researcher used qualitative and quantitative methods. The results indicated the effectiveness of face book as an electronic media in developing technical writing skills and motivation to write.

In conclusion, it can be concluded that using an ESP program based on CALLA can enhance academic reading and

technical writing skills of Microbiology and Biochemistry students at the faculty of Science

3. Context of the Problem:

In spite of the importance of academic reading and technical writing skills, first year students enrolled in microbiology and biochemistry section, Faculty of Science, Obour Campus, Benha University lack these skills.

Out of the present study researcher's experience in teaching the English course for those students through the first semester of academic year 2020/2021, she has observed that first year students encounter difficulties in EFL academic reading and technical writing skills. They cannot write a good paragraph that contains indicators of technical writing skills (style, technical content, grammar and mechanics of writing) or read academic reading texts and deal with the text requirements.

Concerning the Egyptian context, most current Egyptian English language programs do not provide students with opportunities to practice EFL academic reading and technical writing skills in the communicative context. Previous researchers such as (Zaza, 2001; Shehata,2006; Radwan,2017 and Seif,2019) asserted that academic reading is very important to ESP learners as students spend a lot of time trying to understand the material and reflect critically on it, that affects badly on their success in academic reading skills. Moreover, previous studies such as (Zaki, 2008; Farag, 2012) asserted that technical writing is an important part of ESP students' professional work. Accordingly, it is a unique type of writing because its quality affects directly their organization's productivity and profit.

Moreover, the present study researcher prepared electronic needs analysis questionnaire (see **appendix A**) using Google forms and shares it with first year microbiology and biochemistry students, Faculty of science. The questionnaire was adopted from Alsamadani, (2017) needs analysis in ESP context. The questionnaire included two parts:(a) part one was situation analysis that contains questions about their age,total number of courses they taught in English, and one question to rank their ability in English language skills according to their opinions, (b)part two of the questionnaire assess their target needs or skills they need to improve as a result of its importance to their specifications. The needs

analysis addressed (37) first year microbiology and biochemistry students, Faculty of science, Benha University. The findings of the needs analysis were as follows:

- The number of courses they will study at first year is eight courses
- All of courses are taught in English
- Their final examination will be in English
- 100% of students asserted that English language is very important to their specialization
- 91% of students stated that they need to develop reading skills especially academic reading skills as they deal with long authentic reading texts.
- 95% of students agreed that “written materials and developing writing skills is very urgent for them and required for their further studies.

The researcher also, conducted unstructured interview (**See appendix B**) with 5 professors at the Faculty of science who taught in the microbiology and biochemistry Program, Obour Campus, Benha University. All science professors agreed that students have a low level in technical writing as evident in their assignments and examination papers. Moreover, they asserted that academic reading is important to science students and has a great role in their further studies and career in the future.

To document the problem of the study, the researcher conducted a pilot study by administering an academic reading and writing test adopted from (IELTS academic reading and writing exams) which were related to their specialization to measure their academic reading and technical writing skills. The results of academic reading test revealed that most of students (75%) couldn't understand the relationship of the text structure. They also, lack the application skills, coherence, vocabulary and automatic recognition skills of academic reading skills. The results of the technical writing test revealed that first year students at faculty of science (81%) have a weakness related to their technical writing skills (content, style, and mechanics of writing).

The findings of the pilot study revealed that there is a low level of academic reading and technical writing skills of first year students at microbiology and biochemistry section, Faculty of Science, Obour Campus, at Benha university , so this research proposes an ESP program

based on "CALLA" for enhancing academic reading and technical writing skills among these students .

4. Statement of the Study:

In spite of the importance of academic reading and technical writing skills, first year students enrolled in microbiology and biochemistry section, Faculty of Science, Obour Campus, Benha University lack these skills. Hence, the researcher examine the effectiveness of using an ESP program that based on (CALLA) for enhancing academic reading and technical writing skills of first year microbiology and biochemistry students, Faculty of Science, Obour Campus, Benha University

5. Questions of the Study

In an attempt to overcome this problem, the present research attempted to answer the following questions:

- 1- What are the academic reading skills required for first year microbiology and biochemistry students?
- 2- What are the technical writing skills required for first year microbiology and biochemistry students?
- 3- What is the effectiveness of using an ESP program based on CALLA in developing academic reading skills among first year microbiology and biochemistry students?
- 4- What is the effectiveness of using an ESP program based on CALLA in developing technical writing skills among first year microbiology and biochemistry students?

6. Hypotheses of the Study

In the light of the review of literature, the following two main hypotheses are formulated:

- 1- There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of academic reading skills in favour of the post-assessment.**

This main hypothesis has the following six sub-hypotheses:

- a) There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of

detection the coherence relationship of academic reading skills in favour of the post-assessment.

- b) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of finding specific information within charts and graphs of academic reading skills in favour of the post-assessment.
- c) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of predicting the outcomes of academic reading skills in favour of the post-assessment.
- d) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of guessing the meaning of unknown words of academic reading skills in favour of the post-assessment.
- e) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of differentiation between common types of sources of academic reading skills in favour of the post-assessment.
- f) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of distinguishing facts from assumptions and opinions of academic reading skills in favour of the post-assessment.

2- There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of technical writing skills in favour of the post-assessment.

This main hypothesis has the following four sub-hypotheses:

- a) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of transcoding skills of technical writing skills in favour of the post-assessment.
- b) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of defining technical terminology using clear style of technical writing skills in favour of the post-assessment.
- c) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-

assessment of writing a good technical report of technical writing skills in favour of the post-assessment.

- d) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of summarizing the technical text using the concise language of technical writing skills in favour of the post-assessment.

7- Methodology

This part of the research sheds the light on the research methodology that has been followed in investigating the effectiveness of using an ESP program that based on CALLA for developing academic reading and technical writing skills among first year microbiology and biochemistry students, Faculty of Science, Obour Campus ,Benha University. The methodology includes the following points:

A. Participants of the study

B. Research design

C. Instruments and Materials of the study

A) Participants of the study:

The participants of the present study consisted of 37 first year microbiology and biochemistry students, faculty of Science, Obour Campus, Benha University during the first semester of the academic year 2020/2021.

B) Design of the study:

The present study is qualitative and quantitative. Its design is quasi-experimental which is based on manipulating the independent variable and measuring its effectiveness on the dependent variable (Torchin, 2003:29). The experimental one group pre-test and post-test design was used to explore the effectiveness of using an ESP program that based on CALLA in developing academic reading and technical writing skills among first year microbiology and biochemistry students, Faculty of Science, Obour Campus, Benha University.

C) Instruments of the study:

This study aimed at using an ESP program that based on CALLA in developing academic reading and technical writing skills among first year microbiology and biochemistry students, Faculty of Science, Obour Campus, Benha University. The following instruments and materials were developed by the present study researcher to fulfill the purpose of the study:

- 1) The needs analysis questionnaire
- 2) Pre-post academic reading skills test.
- 3) Pre-post technical writing skills test.
- 4) An ESP CALLA -based program

A- Needs analysis questionnaire:

The needs analysis questionnaire was designed to survey the needs of first year microbiology and biochemistry students, at the faculty of science, Benha University. It consists of two main sections;(a) section one was dedicated to their background;(b) section two was to their major and specific language needs(academic reading and technical writing). The researcher adopted many sources for construction the questionnaire such as ALSamadi (2017); AlQtibi (1994); Cacumba (2014); Eroglu (2005) and Songhari (2008) .The questionnaire was the first step for designing the academic reading and technical writing program that aimed to help first year students at faculty of Science to fulfill their academic requirements. The questionnaire was submitted to a panel of five jury members of EFL specialists for validation. The jury members approved the questionnaire after adding some modification such as adding some open questions that students can express their needs that are not mentioned in the questionnaire **(See appendix C for the final version)**.

B- Academic Reading Skills Test.

The researcher adopted IELTS academic reading exams to prepare the academic reading test. The test was administered as a pre and posttest to the study sample to measure their academic reading skills. The test consists of a long reading passage followed by 16 test items with total marks (32). The test consists of six main parts with various questions followed by multiple choices that assess students' academic reading skills. The first part focused on assessing students' ability to detect the coherence relations in the reading text .The second part focused on assessing students' ability to find specific information within charts or graphs .The third part focused on the assessment of prediction the

outcomes of academic reading text. Then the fourth part of the test assessed students' ability in identifying the unknown words. The fifth part of the test assesses students' ability to differentiate between common types of sources. The final part of the test assesses students' ability to distinguish between facts from assumptions and opinions.

-Piloting and scoring the Academic Reading Skills Test:

The academic reading test was administered to a pilot sample of 25 first year microbiology and biochemistry students at Faculty of Science, Benha University to investigate the clarity and suitability of the test to the study sample. No problems were reported with clarity and comprehensibility. Regarding time allocation, the researcher calculated the mean time spent by the first and the last learner to complete the test. The time was about 90 minutes .The test questions were followed by multiple choice answers. The total score of the test was (32).

-Validity of the Academic reading skills Test :

To estimate the **face validity** of the academic reading test, it was submitted to 5 jury members in TEFL (**Appendix D**). They were asked to express their opinions regarding the clarity , the difficulty level and length of the test, and how far each item measures the skill intended to measure. The jury members reported the appropriateness of the test items to the skills to be measured. Clarity of the test instructions and questions and representation of the targeted skills were also reported. For the final form, **See Appendix (E)**.

- Reliability of the Academic Reading Test:

For estimating the reliability of The academic reading skills test, the researcher used the test-retest method. The test was administered to a random sample of first year students at Faculty of science, Benha University, (n=25). The test was administered again to the same group after two weeks. The Pearson correlation coefficient between the two administrations was 0.87 which is statistically significant at 0.01.

C- Technical Writing Skills Test:

The technical writing skills test was administered as a pre and posttest to the study sample to measure their technical writing skills. The test consists of four main parts. The first part focused on assessing students' transcoding ability that means to describe graphs or tables. The second part focused on assessing students' ability to define technical terminology using clear style of technical writing. The third part focused on the assessment of students' ability to write a good technical report. Then the final part of the test assessed students' ability to summarize the technical text using concise language.

-Piloting and scoring the Technical Writing Skills Test:

The technical writing test was administered to a pilot sample of 25 first year microbiology and biochemistry students at Faculty of science, Benha University to investigate the clarity and suitability of the test to the study sample. No problems were reported with clarity and comprehensibility. Regarding time allocation, the researcher calculated the mean time spent by the first and the last learner to complete the test. The time was about one hour. The researcher prepared a rubric to grade students' responses. The rubric covers the test four main parts and the researcher provided ranging indicators to each part. The students are given "3" marks when their performance is high and "1" mark when their performance is low.

-Validity of the Technical writing skills Test :

To estimate the **face validity** of the technical writing test, it was submitted to 5 jury members in TEFL (**Appendix D**). They were asked to express their opinions regarding the clarity, the difficulty level and length of the test. The jury members reported the appropriateness of the test items to the skills to be measured. Clarity of the test instructions and questions and representation of the targeted skills were also reported. For the final form, **See Appendix (F)**.

- Reliability of the Technical Writing Test:

For estimating the reliability of the technical writing skills test, the researcher used the test-retest method. The test was administered to a random sample of first year students at Faculty of science, Benha University, (n=25). The test was administered again to the same group

after two weeks. The Pearson correlation coefficient between the two administrations was 0.89 which is statistically significant at 0.01.

D- A Semi-Structured Interview:

The research conducted a semi-structured interview with the study participants and five science professors at the faculty of science to identify the effectiveness of ESP CALLA-based program in developing academic reading and technical writing skills. The researcher interviewed the study participants and the professors at the end of the treatment. The interview lasted for two hours with ten students. It was developed to gather feedback and students' comments on the ESP CALLA -based program as an instructional tool at the end of the treatment. It includes six open-ended questions where students freely reflect on their learning experiences within CALLA based program (**for the final version, see appendix (G)**). It was submitted to a panel of 5 jury members to determine its validity.

E- An ESP CALLA -Based Program

The **ESP CALLA –Based Program** was developed to develop academic reading and technical writing skills of first year microbiology and biochemistry students enrolled in faculty of Science at Benha university and providing them with some theoretical knowledge about academic reading and technical writing skills and how to practice them to the mastery level of acquiring them (**See Appendix H**)

A- Objectives of the program:

The **ESP CALLA –Based Program** was developed to develop academic reading and technical writing skills of first year students enrolled in the microbiology and biochemistry section ,Faculty of science at Benha University.

The researcher used variety of accomplishments and tasks through the sessions to enable the participants achieve the program aims. By the end of the program, students will be able to :

- Memorize the importance of **ESP CALLA –Based Program in** general and in language learning in particular.
- Acquire the importance of academic reading skills and its applications in their specifications.
- Develop the technical writing sub-skills (style, vocabulary, technical content and clarity in organization)
- Promote their learning autonomy by adapting CALLA strategies.

- Make learning more stimulating and enjoyable by breaking the monotony of classroom events and adopting the CALLA stages.

b- Content of the Program:

The program contained academic reading and technical writing activities and tasks that were suitable for first year students, microbiology and biochemistry section, Faculty of Science, at Benha University and adopted from various sources such as : Abdullah(2016); Amin(2012); Chamot & O'molley (1994); Chamot (2002); Chamot (2007); Eid (2008); Farag (2012); Radwan (2017); Rafidi(2020); Pfeiffer(1994); Wodston(1988) and Zaki(2008).

Description and Framework of the program:

The program consisted of 17 sessions. The first two were orientation sessions about the CALLA based strategies that will be used in the program, the sub-skills academic reading and technical writing and the importance of this skill to the study sample. The rest sessions were instructional ones through which the academic reading and technical writing tasks and activities through CALLA based program was administered. In each session of the program, the researcher used various CALLA strategies even cognitive or metacognitive ones. Moreover, there was a specific sequence for each session based on CALLA five stages and the intended skill to be practiced. The session started with the objectives that study participants would achieve by the end of the session. Moreover; each session contained various tasks to assess students' performance within the session as a kind of formative assessment. At the end of the program, the researcher administered academic reading and technical writing tests to assess students' performance after the treatment and as a form of summative evaluation. (**See Appendix H**)

Implementation of the Program:

A needs analysis questionnaire was administered to 37 first year students at the microbiology and biochemistry section, faculty of science, at Benha University. It aimed at identifying the most needed academic reading and technical writing skills and the best instructional practices they prefer. The results obtained from the questionnaire were statistically treated (see appendix B). Based on the results, the ESP CALLA based program was administered. The treatment of the CALLA- based program started on the 2th of November 2020 and ended up on the 4th of January,

2021. The present study was conducted among 37 first year students, microbiology and biochemistry section, Faculty of Science at Benha University during the first semester of academic year of 2020/2021. The researcher met the participants twice a week in a traditional classroom setting for a total of 32 hours at Obour Campus. The program goes through certain steps as follows:

- The study was carried out following several, systematic stages with the tasks performed by the instructor and the students in each stage adapting CALLA stages as follows:

a -The first stage of the program, (Preparation):

In this stage, the researcher identified the study sample current learning strategies for familiar task, such as recalling their prior knowledge, previewing the key vocabulary and concepts to be introduced to the session objectives. In this stage, teacher also asks students to share the strategy for the whole class. While the participants share the strategy, instructor mentioned a list of strategies that students stated. The purpose of this phase is to find out whether or not students use strategies in accomplishing their task and how they have used it.

b -The second stage of the program, (Presentation):

In this stage, the researcher introduced students one or two strategies which suit to accomplish certain academic reading and technical writing tasks. She gave a name of the new strategy, explain it, tell when to use it, model it and explain the importance of the new strategy, and ask the students if and how they have used it before to practice academic reading and technical writing activities within the session.

c -The third stage of the program, (Practice):

In this stage, the study participants were offered chance of practicing new strategies with authentic academic reading and technical writing activities. They were required to recall writing strategies including cognitive and metacognitive ones that were presented in the previous stage; then students began to plan their writings according to self-planning strategy. Moreover, the content and language skills that are taught by teacher serve as the material that is used to practice the

strategy. The instructor in this stage can use modeling strategy as a part of teaching the text.

d -The fourth stage of the program, (Evaluation):

In this stage, participants were asked to check the level of their writings and academic reading skills so that they could well understand what they had learned about new strategies, skills and what needed to be revised. The instructor used some self-evaluation activities that included self-questioning; examination discussions after strategies practice; learning Blogs in which she asked the participants to record the outcomes of their learning strategies applications; checklists of strategies used; and open-ended questionnaires in which participants expressed their opinions about the usefulness of the session strategies.

e -The fifth stage of the program, (Expansion):

This phase provided the participants with chances to apply higher order thinking skill. In this phase, participants were motivated to apply the strategies that they thought to be the most actual; to allocate new strategies to different context; and to formulate their own individual clarifications of metacognitive strategies. This phase aimed to help students to practice, consolidate, and evaluate the academic reading and technical writing skills that they practiced through the program sessions.

8-Findings of the study

A . Quantitative Analysis of the Findings

The findings of the present research are presented in the light of the hypotheses of the study. To measure the effectiveness of the ESP CALLA -based program, the participants were pre-tested and post-tested on the academic reading and technical writing skills through using the Statistical Package for Social Sciences (SPSS) version 18. The researcher used the paired sample T-test, as it is the suitable design of the study treatment. The findings of the study are given below with the hypotheses of the study as follows:

- The first hypothesis:

The first hypothesis states that "there is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of academic reading skills in favour of the post-assessment ."

For verifying this hypothesis, the paired sample T-test was used to compare the mean scores of the participants in academic reading skills on the pre- and the post administration of academic reading test.

Table (1) :

T-test differences between the participants' mean scores in the pre- and post-assessment of overall academic reading skills .

Skill	Assessment	N.	Mean	S.D.	T-Value	D.F	Sig.	η^2
Overall Academic reading skills	Pre-	37	8.540	2.892	26.011	36	0.01	.94
	Post-		24.540	3.005				

This table shows that the mean scores are **8.540** for the pre-assessment and **24.540** for the post-assessment. The standard deviation (S.D.) is **2.892** for the pre-assessment and **3.005** for the post-assessment, where "t-value" is (26.011) which is significant at the (0.01) level .Thus, the first hypothesis was supported.

The first hypothesis has the following six sub-hypotheses:

- a) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of detection the coherence relationship of academic reading skills in favour of the post-assessment.
- b) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of finding specific information within charts and graphs of academic reading skills in favour of the post-assessment.
- c) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of predicting the outcomes of academic reading skills in favour of the post-assessment.
- d) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of guessing the meaning of unknown words of academic reading skills in favour of the post-assessment.
- e) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of

differentiation between common types of sources of academic reading skills in favour of the post-assessment.

- f) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of distinguishing facts from assumptions and opinions of academic reading skills in favour of the post-assessment.

Table (2)

presents the mean scores, standard deviation and level of the significance in the pre- and post-assessment of the academic reading sub-skills

Skills	Assessment	N.	Mean	S.D.	T-Value	D. F	Sig .	η^2
1-Detect the coherence relations of the text	Pre	37	3.351	1.703	12.576	36	0.0	.81
	Post		7.243	1.588			1	
2- Identify specific information of graphs or tables	Pre	37	1.783	1.397	9.334	36	0.0	.70
	Post		4.378	1.232			1	
3-Predict the outcomes of the reading text	Pre	37	1.891	1.559	16.229	36	0.0	.87
	Post		7.783	1.548			1	
4- Guessing unknown words of reading text	Pre	37	.648	0.949	4.548	36	0.0	.36
	Post		1.621	0.794			1	
5- Differentiate between common types of sources	Pre	37	0.378	0.794	7.756	36	0.0	.62
	Post		1.729	0.693			1	
6-Distinguish facts from assumptions and opinions	Pre	37	0.486	0.869	8.152	36	0.0	.64
	Post		1.783	0.629			1	

Thus, table (2) indicated that the study participants were much better in the post administration than the pre administration in academic reading sub-skills where "t" value is (12.576) for detecting coherence skill, (9.334) for specific information, and (16.229) for predicting the outcomes, and (4.548) for the guessing skills , and (7.756) for the different ion between common resources skills and (8.152) for distinguishing the facts and assumptions skill at the (0.01) level. Therefore, the sub- hypotheses of the first hypothesis were confirmed. Moreover, the total effect size of ESP CALLA –based program on

overall academic reading skills was(.94) that means high percentage (94%).and the sub-skills of academic reading was evident as well.

The second hypothesis:

The second hypothesis states that "there is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of overall technical writing skills in favour of the post-assessment ."

For testing this hypothesis, the paired T-test was used to compare the mean scores of the participants in the overall technical writing skills on the pre- and the post administration of technical writing test. Table (3) presents the mean scores, standard deviation and level of the significance in the pre- and post-assessment of the technical writing skills.

Table (3) :
T-test differences between the participants' mean scores in the pre- and post-assessment of overall technical writing skills

Skill	Assessment	N.	Mean	S.D.	T-Value	D.F	Sig.	η^2
Overall technical writing skills	Pre-	37	4.891	0.875				.87
	Post-		9.487	1.483	15.780	36	0.01	

This table shows that the mean scores are **4.891** for the pre-assessment and **9.487** for the post-assessment. The standard deviation (S.D.) is **0.875** for the pre-assessment and **1.483** for the post-assessment, where "t-value" is (15.780) which is significant at the (0.01) level .Thus, the second hypothesis was supported.

The second hypothesis has the following four sub-hypotheses:

- There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of transcoding skills of technical writing skills in favour of the post-assessment.
- There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of defining technical terminology using clear style of technical writing skills in favour of the post-assessment.

- c) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of writing a good technical report of technical writing skills in favour of the post-assessment.
- d) -There is a statistically significant difference between the mean scores of the participants in the pre- and post-assessment of summarizing the technical text using the concise language of technical writing skills in favour of the post-assessment.

Table (4)
presents the mean scores, standard deviation and level of the significance in the pre- and post-assessment of the technical writing sub-skills

Skills	Assessment	N.	Mean	S.D.	T-Value	D. F	Sig.	η^2																														
1- Transcoding skill	Pre	37	1.135	0.346	9.946	36	0.01	.73																														
	Post		2.378	0.681					2-Defining technical terminology	Pre	37	1.189	0.397	10.321	36	0.01	.74	Post	2.243	0.494	3-write a good technical report	Pre	37	1.351	0.587	6.964	36	0.01	.57	Post	2.378	0.545	4- summarize the technical text using concise language	Pre	37	1.216	0.479	11.147
2-Defining technical terminology	Pre	37	1.189	0.397	10.321	36	0.01	.74																														
	Post		2.243	0.494					3-write a good technical report	Pre	37	1.351	0.587	6.964	36	0.01	.57	Post	2.378	0.545	4- summarize the technical text using concise language	Pre	37	1.216	0.479	11.147	36	0.01	.80	Post	2.486	0.558						
3-write a good technical report	Pre	37	1.351	0.587	6.964	36	0.01	.57																														
	Post		2.378	0.545					4- summarize the technical text using concise language	Pre	37	1.216	0.479	11.147	36	0.01	.80	Post	2.486	0.558																		
4- summarize the technical text using concise language	Pre	37	1.216	0.479	11.147	36	0.01	.80																														
	Post		2.486	0.558																																		

Thus, table (2) indicated that the study participants were much better in the post administration than the pre administration in technical writing sub-skills where "t" value is (9.946) for transcoding skill, (10.321) for defining technical terminology skill, and (6.964) for writing a good technical report skill, and (11.147) for summarizing the technical text using concise language at the (0.01) level. Therefore, the sub- hypotheses of the second hypothesis were confirmed. Moreover, the total effect size

of ESP CALLA –based program on overall technical writing skills was(.87) that means high percentage (87%).and the sub-skills of technical writing was evident as well.

B . Qualitative Analysis of the Findings

The researcher used semi-structured interview to get students' feedback on their participation of ESP CALLA-based program. They expressed their satisfaction of the program in enhancing their academic reading and technical writing skills. The researcher used open-ended questions to get their feedback of the program. The responses were recorded and analyzed by the researcher. They were motivated through using authentic reading and being engaged in technical writing activities. The researcher has also, interviewed five of science professors who taught courses to the study sample. They expressed their satisfaction of students' current performance in reading academic materials or even in writing technical reports. They indicated that the study participants became more competent in mechanics of writing and be aware of the technical content. Thus, it can be concluded that the ESP CALLA-based program was effective in enhancing First year microbiology and biochemistry academic reading and technical writing skills.

9- Discussion and Interpretation of the Study Findings

This part is concerned with the interpretation and discussion of the previously mentioned findings tackled in the previous section of the research. The findings are interpreted and discussed in the light of the study hypotheses.

Concerning the first hypothesis, the findings revealed that there was a statistically significant difference between the participants' mean scores in the pre- and post-assessment of academic reading skill in favour of the post-assessment as T-value was 26.011 which significant at 0.01. This means that the participants achieved more improvement in their academic reading skills. This result confirmed the first hypothesis statistically.

The ESP CALLA based program has proved to be effective in developing the participants' academic reading skills. This development can be attributed to various factors. The researcher used authentic and comprehensible input to develop students' reading skills. She invoked students' interest and curiosity about the target skill. Getting different kinds of feedback from peers

during the reading process was positively received by most of the participants.

The development can be attributed to CALLA stages (preparation, presentation, practice, evaluation and expansion). The activities conducted by the researcher and students in the preparation and presentation stage enable participants to identify each strategy and how to practice it to develop the indicators of academic reading skills. This was consistent with the studies of Vandergrift, Goh, Maresched & Tafaghodtari (2006).

In the preparation phase, the researcher focused on what students already knew and their related experience to the new objectives of the session. She encouraged them to focus on how to relate between the vocabulary they knew and the new vocabulary needed to be taught. Through the presentation phase of the program, the researcher presented the best strategies to present the content of the session even (academic reading or technical writing) so that, students can understand the concepts. Moreover, the researcher modeled certain strategies within the program sessions to remind students how to practice and use the sessions' tasks and activities.

Through the practice phase of the program, students accomplished authentic academic reading and technical writing activities. She focused on the language skills they practiced through the sessions. This phase was wholly student-centered as the researcher used scaffolding that provided more extensive instructional support and gradually withdraw as the participants became more skillful and independent. The researcher explained to the participants how to read for specific purposes by adopting new strategies to enable them to understand the main points in any academic reading text and how to select the main information relevant to the tasks and assignments within the sessions that affects positively on their performance, that was consistent with results of (Carikin,2005, Hellekjaar,2009; Olson &Land,2007)

The participants were trained through the CALLA-based program on how to find specific information within charts, tables and graphs. They were able to guess the meaning of the unknown words. She encouraged them to read charts and diagrams and to give a summary of the information in the chart to show the visual links of it. She asked the participants to think about the relationship between the ideas in the text, as the parts of the chart have a different division than the text. Through

the ESP program that based on CALLA participants trained on how to detect the coherence relationship such as the main idea and the supporting details. They detected the cognitive relationship within the text such as cause and effect, time sequence and spatial sequence and that developed their academic reading level, that was consistent with various studies such as (Ajideh, Zohrabi, & Pouralvar ,2018).

Developing students' academic reading skills was attributed to using CALLA based program strategies (cognitive, metacognitive and social/affective) .The program helped the participants to analyze the reading text ,predict the outcomes, control their own reading and draw conclusions. They were able to relate their previous knowledge to their new concepts to construct a new meaning from the text. Through the program sessions' the participants were engaged in group work and peer work activities that enables them to develop their automatic recognition skills of academic reading. They became more competent in reading tables, charts, graphs and maps to find specific information. Adapting the Practice stage in CALLA based program enables the participants to identify the meaning of unknown words from the context. The researcher's role as a monitor, facilitator and guide enable the study sample to study the text connectors' relations such as prefixes and suffixes. That was consistent with results of (Hamifah and Afidan, 2018; Rifdi, 2020 and Rahman,2020)

Concerning the second hypothesis, the findings revealed that there was a statistically significant difference between the participants' mean scores in the pre- and post-assessment of technical writing skills in favour of the post-assessment as T-value was 15.780 which is significant at 0.01. This means that the participants achieved more improvement in their technical writing skills. The program gave students the chance through modeling stage to practice the intended language skills that followed by independent practice for students.

The program enables the students to work in a communicative context of learning environment, where students were active learners. They were able to practice the transcoding strategies and to write instructions of table or charts. Using visual, gestures and demonstrations supported students' development of technical writing skills. The researcher used group and peer work activities through the practice stage of the program. Students were taught how to use note-taking, elaboration, and auditory representation strategies that helped in writing

the details of technical report in a good technical style. Moreover, the ability of the participants to describe graphs and to write instructions of technical process increased throughout the program sessions. The researcher used CALLA based strategies such as advanced organizer to evaluate and expand on their own knowledge, that was consistent with studies such as (Alshrman,2018 and Abdrabo,2020)

The ESP program that based on CALLA was effective in developing technical writing skills as the researcher practiced the five main steps of CALLA. Within the technical writing sessions of the program, the instructor asked students to focus on four main stages in writing. She asked the participants to establish their primary purposes of writing and assess their audience or readers and the context. The researcher asked them to determine their scope of writing in order not to spend needless hours in searching information. The present study researcher urged them through the sessions to select the most appropriate medium for communicating the message. There are various aspects of writing such as e-mail, memos and reports. They practiced on how to make adequate research even through h internet investigation or to note-taking and documenting sources. The researcher trained students through the session on how to practice methods of development in writing papers, such as the sequential method of development in writing, the chronological method and the cause and effect method that has a positive effect on their performance, that was consistent with the results of (Gragson&Hagen,2010).

Participants practiced writing technical reports outlines through the sessions of the program. Outlining activities through the CALLA-based program enabled them to focus on the main points and placing them in the position of greatest importance. The participants were trained on how to expand the first outline in writing to larger paragraphs. They were asked to read and evaluate their writing and check their first draft accuracy, completeness and effectiveness for achieving the purpose of writing as a whole. Finally, participants became self-evaluative to their writing and how to check their unity, coherence and apply mechanical correction such as spelling, punctuation for proofreading that developed their performance in technical writing skills , these results were consistent with other studies such as (Mansour, Talafhah, AlJarrah and Alshorman,2018; Yu,2007).

Concerning the evaluation phase of the program, the instructor raised students' metacognitive awareness to be able to check their level of performance. The researcher used various instructional activities such as individual, cooperative or even under her guidance. In the expansion phase of the program, the researcher tried to connect the topic of the session to students' own lives, culture and language. As a result, students became competent to transfer what they have learned to new learning situations. Thus, she gave the participants the chance to think about their new skills and concepts and gradually developed their performance, that was consistent with studies such as (Nartisal, 2013; Yufizal, 2019)

Thus, the five phases of the ESP CALLA based program were effective in developing academic reading and technical writing skills among first year microbiology and biochemistry, faculty of science students.

10- Conclusion

The results of the study asserted that the participants' academic reading and technical writing skills were developed through the implementation of the ESP CALLA -based program. The implications from the findings of this study support that CALLA phases are useful stages for practicing Language skills. Participants can gain knowledge in a democratic and relaxing atmosphere and where learns accept the comments from others. The effectiveness of the program was determined by the phases of implementation through each session of the program. (Anderson,2005;Chamot and Robbins,2006)

Academic reading is very important to Biochemistry and microbiology students, as they use it to access information. As a result, they need specific training to develop this skill. It affects positively on their success in life. Therefore, if students have poor reading skills, they will have difficulty in achieving success even in their academic or general life. Before implementing the ESP CALLA-based program, there was lack in academic reading and technical writing among the study sample. They don't have the ability to deal with the academic reading materials with its main features and don't have the ability to write a good technical report. The researcher throughout the session's program focuses on five main stages of CALLA and used it to practice technical writing and academic reading skills.

It can be determined that the program sessions' helped students to understand what they learn and to make sense of it to focus on the meaning they already know and make a connection to the new concepts. Through the program the participants were active and being engaged in activities that require them to use inquiry and problem solving. The researcher provided students with reflective feedback about their responses to the sessions' tasks and this motivated them (Cohen, 2008; Chamot & O'Malley, 1994 and Chamot,2000).

Moreover, it can be concluded that using different cognitive, metacognitive and social and affective strategies within CALLA based program was effective in developing academic reading and technical writing skills.

11- Recommendations of the study

The results of the research offered a number of recommendations as follows:

- More attention should be paid to the importance of academic reading and technical writing skills for science students.
- More attention should be paid to CALLA five stages (preparation, presentation, practice, evaluation and expansion) as were proven to be effective in developing academic reading and technical writing skills among faculty of science students.
- Students should learn different types of language strategies (cognitive, metacognitive, and social or affective) that can be used as pre, during and post any language skill practice.
- Teachers should pay more attention to students' development of academic reading and technical writing skills in the secondary stage to be competent in the university stage.
- Teachers' preparation programs should include the training of CALLA program in all courses.
- Integrating the CALLA program with the development of English courses and curriculum.

12- Suggestions for further Research

Within the limitations of the present study as well as the findings being achieved, the following areas are suggested for further research:

- 1- Using CALLA for developing listening and speaking skills among ESP students.
- 2- Using CALLA for developing strategic reading and listening skills among secondary stage.
- 3- Using CALLA in developing self-regulation strategies and higher order thinking skills among university students.

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