

**Using a Hybrid 5E Instructional Model to Improve Higher
Order Thinking and Self-directed learning skills of EFL
Students**

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Abstract

The aim of the current study was to identify the effectiveness of using a Hybrid 5E Instructional Model in Microteaching course to improve university students' Higher Order Thinking (HOTS) and Self-Directed Learning Skills (SDLS). The participants of the study were 58 (Total number) 2nd year EFL primary section students at the Faculty of Education, Minia University. The quasi-experimental design with one group serving as the experimental group, while the other serving as the control group was adopted. They participated in the field study, which took place in the second term of the academic year 2021/2022. Four instruments were used to collect the quantitative data of the study: a language placement test, an achievement test in HOTS, a SDLS scale, and a Hybrid 5E instructional model questionnaire. Findings of the study revealed statistically significant differences due to the training, favoring the experimental group, in the post-administration of HOTS test as well as the SDLS scale. Accordingly, the suggested

Hybrid 5E instructional model was found to have a positive effect on nurturing HOTS and SDLS EFL students. Suggestions for further research and recommendations were presented.

Ky words: Higher-Order Thinking Skills (HOTS), Hybrid 5E instructional model, Self-Directed Learning (SDLS).

استخدام النموذج التعليمي الهجين القائم على 5E لتحسين مهارات التفكير العليا ومهارات التعلم الذاتي لطلاب اللغة الإنجليزية كلغة أجنبية

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مستخلص

هدفت هذه الدراسة إلى التحقق من أثر استخدام نموذج 5E التعليمي الهجين على تنمية مهارات التفكير العليا ومهارات التعلم الذاتي لطلاب الفرقة الثانية بكلية التربية تخصص اللغة الإنجليزية في مقرر التدريس المصغر. اشترك في الدراسة ثمانية وخمسون طالبا وطالبة بكلية التربية، جامعة المنيا . استخدمت الدراسة المنهج شبه التجريبي لتحقيق أهداف البحث حيث تم تقسيم عينة الدراسة إلي مجموعتين متكافئتين أحدهما تجريبية والأخرى ضابطه خلال الفصل الدراسي الثاني للعام الجامعي ٢٠٢١/٢٠٢٢. وتم إستخدام مجموعه من الأدوات لقياس أثر التدريب إشملت على إختبار للغة ؛ وإختبار مهارات التفكير العليا ومقياس مهارات التعلم الذاتي وكذلك إستبيان نموذج 5E التعليمي الهجين. ومن خلال تحليل البيانات ، توصلت الدراسة للآثر الايجابي للتدريب بإستخدام نموذج 5E التعليمي الهجين حيث وجدت فروق ذات دلالة إحصائية فى الإختبار البعدى لمهارات التفكير العليا ومقياس مهارات التعلم الذاتي لصالح المجموعه التجريبية. وقد تم عرض النتائج ومناقشتها. كما اشتملت الدراسة على أهم التوصيات والمقترحات لبحوث مستقبلية .

الكلمات المفتاحية: مهارات التفكير العليا ، مهارات التعلم الذاتي ، نموذج 5E .

Introduction

In recent years, the epistemological view of education has been drastically altered. Learners have been turned into active participants and deep learners who hold responsibility of their learning process. They need to be equipped with essential skills and competencies that enable them to learn by themselves. The 21st century requires learners who don't seek to know facts, but to comprehensively understand these facts and put them in contexts exploring relationships among different contexts. Therefore, the 21st century instruction should focus on abilities and practices that enable learners, particularly university students, to apply new knowledge, elicit information and develop their higher thinking skills. They need to be exposed to experiences and activities which enrich their ability to take charge of their lifelong learning skills: autonomy, self-control, self-directedness, inquiry ability, independence, decision-making and self-regulation. Among the fundamental skills required to survive in the 21st century are Higher-order thinking skills (HOTS) and Self-directed learning skills (SDLS).

Higher-order thinking skills (HOTS)

In a growing number of learning contexts, HOTS is globally boosted and emphasized to be a crucial aspect of instruction to foster students' thinking and improve classroom learning. A literature review of 15 articles selected by Hamzah, Hamzah & Zulkifli (2022) revealed the importance of inculcating HOTS in classrooms to produce a generation fit for the 21st century. HOTS demands higher levels of the cognitive process that can promote creativity, critical thinking, and problem-solving and inquiry abilities among students. HOTS should be implemented in all educational levels, in particular, university one (Shivam & Mohalik,

2022). HOTS are considered a core focus of education and a dynamic learning aim to produce a generation who can cope with the 21st century challenges. Students' ways of thinking can remarkably affect their ability, speed, and effectiveness of learning. Students' construction of cognitive knowledge could be meaningfully developed through HOTS, as it is the level of thinking required to shape their performance. HOTS encourage students to sort data from information obtained, identify possible solutions, to provide an opinion about the selected data (Su, 2021). Analysis of thought processes, evaluation, and creation to inquire into a problem are involved in HOTS where students have opportunities to distinguish ideas, make hypotheses and construct explanations well (Miterianifa et al., 2021). To improve learning progress and students' performance, HOTS are recommended as basic competencies emanating from a natural inquiry in which students can employ the skills of analyzing and manipulating complex information, activating prior knowledge, connecting ideas, selecting appropriate solutions, and developing insightful reasoning (Saepuzaman, et al., 2021).

Self-directed learning skills (SDLS)

Challenges of 21st century require persons who can shape their own lives, make choices and hold the fort for those choices which gave great concern on developing students' life-long learning skills. Self-directed learning skills are among the required 21st century skills that can successfully achieve this goal. Knowles (1975) gave a comprehensive definition of Self-Directed Learning (SDL) referring to it as *"a process in which individuals take initiative, with or without the help of others, in diagnosing their own learning needs, formulating goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes"*. Self-

directed learning skills are seen to be rooted in the implementation of HOTS as they are strongly interconnected. Students' willingness to drive their own learning is so essential in maintaining such skills. Equipping learners with SDLS helps them autonomously link previous knowledge with new one, monitor understanding, inquire about misconception, recap types of questions, comprehend the learnt information, and apply it in a practical context. (Anshu, Gupta & Singh, 2022). Through acquiring SDLS learners are given the freedom and autonomy to choose what, why, and how presumably to learn where they become "*own learning change agents*". It could influence not only academic performance of learners but their future professional development as well (Demir & Ilhan, 2022). SDL emphasizes learners' autonomous exploration, spontaneous discovery and construction of knowledge, and learning process tracking which boost their self-management, reflection and assessment. In SDL, the student is entirely responsible not only for shaping the goal of the learning process but the way in which the goal is executed as well (Li, Yang & Hu, 2022). It is stated that SDL and Self-regulation are used interchangeably in literature comprising skills as personal responsibility, autonomy, self-monitoring, and self-control. Teachers' definitions of SDL largely influence their success in enhancing it in their students. Their interpretations varied from the learners' ability to work independently, to their ability to make decisions about learning goals, resources and content. Providing students with clear instructions and well-organized learning material could have a positive impact on stimulating their SDLS (Voskampa, Kuiperb & Volman, 2020). For a successful implementation of SDLS, learners should be encouraged to develop their interpersonal communication skills, self-efficacy and self-regulation, increase their

competency to search learning resources and feel responsible for their own learning outcome (Bhandari, Chopra & Singh, 2020).

Since traditional concept of learning is no longer satisfying intended goals of the 21st century, learners need innovative models of learning and teaching which enable them to seek, construct and recap knowledge. Therefore, literature asserts that equipping university students with skills as inquiry, HOTS and SDLS are widely recommended and a learning model of stimulating thinking skills is prerequisite. Accordingly, the Hybrid 5E Instructional model could have the potential to achieve that target to enable learners to tackle with the 21st century challenges accompanied.

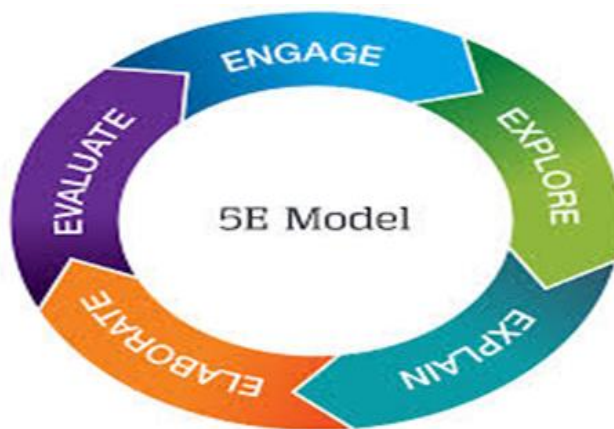
The Hybrid 5E Instructional model

Thinking is profoundly aspired by questions which deliver meaningful inquiry experiences. When choosing an instructional model, teachers seek strategies that help students gain a complete understanding of new concepts. They aim to engage students, motivate them to learn, and guide them toward skill development. One of the ways to do that is by incorporating inquiry-based approaches like the 5E Model, which is grounded in active learning. The 5E Instructional model was first introduced in 1980's by Bybee and his Biological Science Curriculum Study's (BSCS) team where new curriculum materials and professional development experiences were intensively claimed. The rationale of this model is based on the constructivist, inquiry concept of learning which calls for the active participation of students in knowledge structure and fundamental concepts in science and other domains were introduced (Bybee 1997).

The 5E Instructional model, which rapidly gained considerable attention and support among educational researchers, provides multiple

opportunities to the processes of student engagement, meaning making, question posing, self-reflection, data gathering and interpretation. Creativity, critical thinking, and problem-solving abilities among students can be promoted through using the model (Shivam & Mohalik, 2022). It is a “student-oriented” learning model that is based on five main cognitive phases which encourage students to engage in different meaningful activities aiming to gain deep understanding, represent their thinking, master certain skills, analyze their own evidence, communicate ideas with others and change their initial concepts. Enabling students to go through the different stages of the 5E instructional model proved to have an impressive value on empowering them with the ability to actively build knowledge and experiences, individually or within a group learn the given material, dynamically explore meaningful tasks, and positively contribute to the attainment of different competences (Francesc et al., 2021).

Using digital devices and online applications in educational settings have been widely endorsed. Therefore, integrating the 5E Instructional model with technology was highly advocated aiming to foster autonomous learning and higher thinking levels. The 5E model phases as introduced by Bybee (2019) are: engage, explore, explain, elaborate, and evaluate as shown in the following figure:



(Source: Teacher Tube, 2018, <https://www.google.com>)

Engage

In this phase of the model, students' prior knowledge is assessed and any possible misconceptions are identified. This helps teachers to anticipate activities that reflect students' thinking levels and enable them to make connections between past and present learning experiences. Engagement phase starts with an opening, novel question followed by activities that make students entirely engaged in the learning tasks, create a desire and motivation to learn more about the upcoming topic and promote curiosity.

Explore

During this phase, without the intervention of teachers, students are encouraged to use cooperative learning and work with their peers to actively manipulate materials and explore the new concept through 'hands-on' activities. The exploration phase is fundamentally an 'inquiry-based activity' in which students are exposed to concrete learning experience and are provided with multiple opportunities to carry out such skills as observing, questioning, investigating, testing predictions and hypothesizing.

Explain

This phase is pigeonholed as 'teacher-led' tuition. Under the teacher's supervision, students are able to explain previously explored concepts, describe understanding, synthesize new knowledge, pose questions for further clarification and share their ideas and experiences. After giving students the opportunity to express their own explanations and present concepts, teachers provide a formal definition and explanation for them.

Elaborate

The elaboration phase is considered the ‘hands-on’ phase of the model in which students are applying what they’ve demonstrated in previous phases. Students are given further opportunity to practice desired skills and behaviors in new contexts which broadens their understandings and extends their experiences. Students are asked to create presentations, conduct supplementary inquiries and design new models to reinforce and retain the learned concepts and skills.

Evaluate

This is the final phase of 5E model in which students are able to review and reflect on their own learning and conceptual understanding. During this phase, teachers are able to conduct both formal and informal assessment and enables them to gauge student’ mastery of core concepts and skills and their progress toward achieving the intended performance. In this reflective phase, students have opportunity for modifying their thinking, concepts, abilities and skills. Integrating

Literature Review

Different studies were interested in exploring the impact of inquiry based learning, namely the 5E Instructional model as extremely recommended, on improving learners’ HOTS and SDLS. For example, Shivam & Mohalik (2022) examined the efficiency of ICT integrated with 5E inquiry model on students’ HOTS at secondary level. Analysis of collected data showed that the model provided positive results on improving students’ performance in HOTS and those students who learnt through the model achieved

significantly better. Saepuzaman, et al. (2021) as well pointed to the significant effect of the inquiry model on promoting such aspects of students' performance as analyzing, evaluating, creating, critical and creative thinking skill that ought to be developed in the 21st century. Using instruments such as observations, interviews, and tests in collecting study data, Kurratul & Ridwan (2021) explained that the 5E model with stages of engagement, exploration, explanation, elaboration, and evaluation was so effective in developing students' abilities to work on questions with higher-order thinking skills. With an attempt to boost the quality of learning, Anggraeni & Suratno (2021) utilized the 5E learning model including some social and instructional impacts to estimate its effectiveness in enhancing students' critical thinking skills by posing HOTS questions. They declared that the model was helpful for teachers to implement in classrooms, allowed students to be more engaged in the learning process and improved their higher thinking skills. Similarly, Agustin, Oktavia & Rahadian (2020) found a significant increase in learning the activities and higher thinking skills that were based on 5E Bybee Model. Analysis of collected data showed that students' level of thinking skills reached 0.76 which was considered as high criteria. Their results showed that using this model was very pertinent and relevant for fostering students' understanding of different concepts.

A study conducted by Rosli, Ramlee & Saleh (2019) proved that the application of online 5E model was capable of increasing and nurturing students' HOTS ability. They also referred to the valuable impact of the online 5E model as it created a motivating learning environment. The training model was accompanied with appropriate pedagogical techniques and enriching activities which made participants fully engaged in tasks.

The researchers finally stated that fostering learners' HOTS is highly recommended.

Due to the prominent attention of inculcating HOTS to promote learners' thinking abilities, other researchers utilized different strategies. Jager (2019), for example, examined the impact of using e. portfolio to develop student teachers' HOTS which was effective; for the same purpose, Jamari et al. (2017) used social media and Facebook which proved to offer active interaction and collaboration among participants, which eventually fostered their HOTS and problem solving skills. A study done by Alsowat (2016) investigated the effectiveness of using flipped classroom teaching model in developing graduate students' HOTS, engagement and satisfaction which made a significant change in students' performance. This means that providing an innovative learning environment could mostly be successful in improving students' thinking skills, self-regulation, self- management, self-monitoring, and autonomy.

Studies also attempted to investigate the effectiveness of the 5E instructional model on self-directed learning, e.g. Gadicherla et al. (2022) used a validated questionnaire to explore the impact of problem solving and inquiry learning model on students' self-directed skills. Results showed that the model was so effective in promoting participants' self-directed learning, critical thinking, sharing information and working in a team. Participants of the study also expressed the effectiveness of the model which helped them to assess their weaknesses as well as enabled them to establish a concrete action plan to achieve their targets.

Geng, Law & Niu (2019) examined the impact of blended learning based on inquiry model on self-directed skill, technology readiness, and learning motivation. The results indicated that the model provided good facilitation for students' engagement in the class and enhanced collaborations among

students. It also created an interrelated environment based on inquiry tasks which promoted students' self-directedness, motivation and readiness. In their studies, Ibrahim, Marini, & Solihatin, (2018) and Cho, Kim, & Choi (2017) aimed to explore how far implementing an inquiry 5E model could be effective in enhancing students' interpersonal intelligence and self-regulation as one of the self-directedness aspects. Results indicated that there was a mutual effect and an interrelation between the learning model and students' self-regulation, self-monitoring. Students' interpersonal intelligence was higher and developed as well. Analysis also revealed that students, who were highly self-directed, demonstrated a stronger sense of inquiry tasks, felt more responsible for executing a task and achieved higher affective outcomes. Akgunduz & Akinoglu (2016) investigated the effect of blended learning and social media with 5E learning cycle model on students' attitude and self-directed learning skills. An attitude scale and a self-directed learning skills scale were used to collect data of the study. Results revealed that using both blended learning and social media with 5E learning cycle model had a positive impact on students' attitude and self-directed learning skills.

Owing to the effectiveness of using 5E instructional model, many studies introduced as a way of improving different aspects of learning, for example, Diyyab (2021) improved ESP students' academic writing through using a suggested program based on 7E instructional model and Automated Writing Evaluation (AWE) systems. The model gave positive results of students' improvements. Kalaitzi & Volioti (2021) integrated 5E model with ICT based activities which was valuable in providing numerous opportunities for students to build new knowledge through inquiry and active engagement. It also enhanced their confidence and self-management when dealing with ICT activities. Within a hybrid course,

Garderen et al. (2020) used 5E model in the pre-service preparation program to develop students' learning abilities. It proved to be beneficial for students by aiding them to structure the course content and providing them with ample experiences in active and inquiry based learning environments.

Moreover, findings of a study conducted by Ong et al. (2020) revealed that the 5E Model was effective in enhancing knowledge on content used, empowering STEM-based inquiry learning, and promoting collaboration in the classroom among science teachers. The 5E Instructional Model was also found to have a positive impact on improving high school students' achievement level in essay writing in EFL writing courses according to the study results of Secer and Yucel-Toy (2020). Naguib (2019) as well referred to the significant effect of 5E instructional model on developing secondary stage students' grammar learning. It was also concluded that the model could be used to enhance English learning in TEFL classes giving a recommendation of using it in different language courses. Keely (2017) highlighted that using 5E Instructional Model developed formative assessment in classroom techniques as it is strongly interconnected with each phase of the model which has it great effect learning.

Commentary

The aforementioned studies evidently proved the tremendous effectiveness of the 5E instructional model, whether online, face-to-face or hybrid, in improving learners' performance and achievement in various fields. It was also apparent that, HOTS, SDLS and inquiry ability are among the core skills prerequisite for the 21st century. As noted earlier, some studies were interested in enhancing HOTS, whereas others attempted to develop SDLS. To the best of the researcher's knowledge,

using a Hybrid 5E Instructional model to enhance HOTS and SDLS together is still newly applied in teaching EFL contexts and has not been carried out before. This motivates and encourages the researcher to scrutinize its effectiveness in language learning courses.

Context of study

In the light of the researcher's personal experience, as an instructor, teaching EFL students in different courses at the Faculty of Education, Minia University, it was obvious that 2nd year EFL primary section students in the current study lacked the ability to differentiate among the different HOTS. They had difficulty in answering HOTS questions and their levels of thinking were very weak. To document the problem, a test on HOTS was administered during the first term of the academic year 2021/2022.

Results of the test revealed students' poor performance as they got very low scores which indicated that they lacked these fundamental skills. Inculcating EFL students in Methodology and Microteaching courses, the researcher also noticed that the majority of these students lack the ability to work independently or even finish a task making depending their own choices and decision. A questionnaire was also administered to check students' knowledge on the 5E instructional model and its different phases which gave an indication of their insufficient knowledge about the model. Validity and reliability of the instruments were tested during the pilot study.

Statement of the problem

It is commonly observed that EFL students could recognize lower order thinking items and questions but found great difficulty in identifying HOTS items and questions. They did not get satisfactory training and

sufficient strategies in which HOTS are implemented. They always needed help from others to make a suitable decision or choose a right answer. A Hybrid 5E Instructional model was suggested to improve 2nd year EFL primary section students' HOTS and Self-directed learning skills.

Questions of the Study

The present study was conducted to answer the following question:
What is the effectiveness of using hybrid 5E instructional model in enriching EFL students' HOTS and Self-Directed Learning skills?

The following minor questions emanated from the above major one:

1. What is the effectiveness of using hybrid 5E Instructional model in enriching EFL students' HOTS?
2. What is the effectiveness of using a hybrid 5E Instructional model in enriching EFL students' Self-Directed Learning skills?

Objectives of the Study

The current study attempted to:

1. Identify the effect of using a Hybrid 5E Instructional model on enhancing EFL students' HOTS.
2. Identify the effect of using a Hybrid 5E Instructional model on enhancing EFL students' Self-Directed Learning skills.

Hypotheses of the Study

1. There would be a statistically significant difference between mean scores obtained by the students of the experimental and the control groups in the HOTS post-test favoring the experimental group.
2. There would be a statistically significant difference between mean scores obtained by the students of the experimental group on the pre-post HOTS tests favoring the post.

3. There would be a statistically significant difference between mean scores obtained by the students of the experimental group on the pre-post SDLS scale favoring the post.

Significance of the Study

The significance of the study lies on:

- Shedding light on other important 21st century learning skills, namely, HOTS and SDLS that mostly needed by pre-service teachers in such a knowledge oriented era.
- Providing an instructional strategy based on using 5E Instructional model to develop EFL students' HOTS and SDLS.
- Trying to fill the gap in the review of literature in Egypt.
- Offering online activities on HOTS, 5E phases, inquiry items, a HOTS test and a SDLS scale.
- Providing opportunities for students to enhance their computer skills.

Delimitations of the Study

1. The study was delimited to 58 (whole number) 2nd year EFL primary section students at the Faculty of Education, Minia University.
2. The study was implemented in the “Micro-teaching” course in the second term of the academic year 2021/2022.
3. HOTS skills were limited to the cognitive processes of the revised Bloom’s taxonomy.
4. Self-Directed Learning skills scale was divided into two basic domains: Personal Responsibility and Autonomy.

Definition of Terms

Higher Order thinking skills (HOTS):

Wikipedia (2022) defined HOTS as “The ability to apply knowledge, skills, and values through reasoning and reflection to solve problems,

make decisions, innovate, and successfully create something”. Whereas, Miterianifa et al. (2021) defined HOTS as “The capacity to think fundamentally in accepting different kinds of data, think imaginatively in taking care of issues utilizing their insight, and settle on choices in circumstances”.

HOTS is operationally defined as a set of intellectual processes which entailed students to analyze specific information, examine perceived relationships, meaningfully connect ideas together, evaluate final outcomes, and produce new outcomes.

Self-Directed Learning (SDL)

Self-Directed Learning is defined as “a modality where learners are expected to take responsibility for their own learning, diagnose gaps in their learning, frame their own goals and resources for learning, implement appropriate learning strategies and evaluate learning outcomes”(**Anshu, Gupta & Singh, 2022**).

Demir & Ilhan (2022) also defined SDL as “a purposive mental process, where the learners take responsibility for their own learning accompanied and supported by behavioral activities involved in identification and searching for information”.

Self-Directed Learning is operationally defined as the ability of EFL students to take over responsibility, monitor, manage and control the task of their own learning.

A 5E Instructional model

Bybee (2019) referred to 5E model as “a Learning cycle approach for inquiry-based science teaching that provides a carefully planned sequence of instruction that places students at the center of learning

encompassing five phases: Engage, Explore, Explain, Elaborate, and Evaluate”.

It is operationally defined as a mixed, online and face-to face, instructional model comprising a series of five systematic main cognitive phases in terms of engaging, exploring, explaining, elaborating and evaluating.

Study Design

The present study utilized the quasi-experimental research design to examine the impact of the Hybrid 5E Instructional model on students' Higher Order Thinking skills (HOTS) and Self-directed learning skills (SDLS). The participants were assigned into the experimental and the control groups. Both groups were exposed to pre-post HOTS tests to measure their skills before the intervention. A scale was administered to the experimental group only to gauge the differences between students' SDLS before and after the intervention. The researcher taught and trained both the experimental and the control groups.

Variables of the Study

Independent Variable

- A Hybrid 5E Instructional Model.

Dependent Variables

1. Students' level of Higher Order Thinking Skills
2. Students' level of Self-Directed Learning Skills

Participants

This study was conducted during the second term of the 2021/2022 academic year at Faculty of Education, El-Minia University. The participants comprised 58 (total number) English Majors enrolled in

second year, primary section, who were assigned randomly into an experiment group (n=29) and a control group (n=29). They were almost of the same age and years of studying English. The experiment group received instruction with the Hybrid 5E model, whereas the control group adopted the usual instruction. To make sure of participants' equivalence, a language placement test was administered to measure students' language proficiency level and a pre-test of HOTS to measure their entry level. The findings showed no significant differences between the two groups as presented in the following tables:

Table (1) Means, Standard Deviations and t-value of Participants' Language Proficiency Test

No	Group	Mean	SD	DF	t-value
29	Experimental	29.62	5.40	56	*0.212
29	Control	29.93	5.58		

*Not Significant at 0.05 level

Table (2) Means, Standard Deviations and t-value of Participants in Pre- HOTS Test

No	Group	Mean	SD	DF	t-value
29	Experimental	15.83	1.11	56	*0.230
29	Control	15.90	1.12		

*Not Significant at 0.05 level

Before conducting the experiment, the instruments of the study have been piloted in order to verify their suitability in terms of validity, reliability, difficulty, and time. The pilot study was carried out on a random sample of 27 2nd year EFL students at the Faculty of Education, Minia University in the first term of the academic year 2021/2022 before delivering the hybrid 5E instructional training module. Piloting the instruments of the study facilitated making any modification proposed by the jury members.

Instruments of the study

Since the study aimed to investigate the impact of a Hybrid 5E Instructional model on students' HOTS and SDLS, three different tools

were utilized. These instruments were a HOTS test, a SDLS scale and a 5E questionnaire.

1. A Hybrid 5E Instructional Model questionnaire
2. A HOTS Test
3. A SDLS Scale

1. The Hybrid 5E Instructional Model questionnaire

This questionnaire was basically designed by the researcher to identify students' background knowledge about the 5E Instructional model. It consisted of twelve questions delivered to students to be answered whether by choosing 'Yes, 'Not sure' or 'No. The questionnaire was submitted to a panel of TEFL experts, to evaluate its suitability and necessity for the participants. The jury members approved the face validity and appropriateness of the questionnaire. For final form see Appendix (A).

2. A HOTS Test

This HOTS test, prepared by the researcher, aimed to assess students thinking skills in (analyzing, evaluating and creating). The items were reviewed by some TEFL experts. 46 questions were formed divided on three levels; (analyzing (18 items), evaluating (16 items) and creating (12 items)). Based on the TEFL experts' assessment, some modifications were made and the final test had 40 questions; (analyzing (16 items), evaluating (14 items) and creating (10 items). The test was constructed according to a table of specification and consisted of 19 multiple choice questions with three distracters (a, b, c) and 21 productive items having equal marks i.e. one mark for each question. The duration of the test was one hour and twenty (80 minutes). The test was administered to a pilot group of 27 EFL 2nd year students at the Faculty of Education to verify its reliability,

difficulty coefficients and discrimination coefficients. For final form see Appendix (A).

The test was reliable as Cronbach's Alpha (α) was found (0.881); the difficulty coefficients ranged from (0.32 to 0.740), and the discrimination coefficients ranged from (0.590 to 0.770). The internal consistency of each test items ranged from (0.625 to 0.901) and the internal consistency of each sub-skill of HOTS ranged from (0.751 to 0.911) which indicated a high validity of the test as shown in the following table:

Table (3) Correlation Coefficients between each domain and the total sheet HOTS Test (No=27)

Sub-Skill	R
Analyzing	0.751*
Evaluating	0.771*
Creating	0.911*

*Significant at 0.01 level

3. A SDLS Scale

To explore students' SDLS, a 30-item, five-point Likert scale, ranging from (Strongly Disagree to Strongly Agree) was formed and given to the experimental group only. Based on the review of literature, the scale comprised two basic domains: Personal Responsibility and Autonomy. The scale was administered to the same pilot group which consisted of 27 EFL 2nd year students at the Faculty of Education to verify its reliability and validity. The scale was reviewed by a number of TEFL experts who confirmed its suitability and belongingness of its main domains to sub-domains. The duration of the scale was forty five minutes. Scale reliability was verified using Cronbach's Alpha and it was (0.900) considered as high (Table (4)). The internal consistency of each scale items with the total SDLS scale ranged from (0.601 to 0.940) and the internal consistency of each sub-skill of the scale was (0.876) for Personal Responsibility domain

and was (0.881) for Autonomy which indicated a high validity of the scale as shown in table (5).

Table (4) Cronbach Alpha's reliability Coefficient of the SDLS Scale

No=27

Variable	Alpha
SDLS scale	0.900*

*Significant at 0.01 level

Table (5) Correlation Coefficients between each domain and the total sheet of the SDLS Scale

N=27

Domain	R
Personal Responsibility	0.867*
Autonomy	0.818*

*Significant at 0.01 level

Treatment of Learning Materials and Techniques

- Before the treatment, a pre-administration of HOTS test was implemented on both the experimental and control groups. Whereas, the pre-testing of SDLS scale was conducted only on the experimental group. Pre-testing aimed at measuring participants' entry level before the real intervention.
- The experimental group was taught the Micro-teaching course in the light of the Hybrid 5E Instructional model that was developed by the researcher.
- The training was basically divided into two basic parts; an online format (synchronously and asynchronously) via a Facebook closed group created by the researcher, and a face-to-face learning format. The implementation of the study lasted for 12 weeks (two hours per week in class and nearly 2 hours online).

- The intervention started with a face to face orientation session which aimed to set instructions and organize work among participants throughout the hybrid training.
- According to the adopted 5E Instructional model, the course was organized as a hybrid training session through which the material was delivered. It was divided into five basic phases (Engage, Explore, Explain, Elaborate and Evaluate).
- **In the “Engage” phase**, students' interests were stimulated through posing questions, exploring a website, watching a video; a powerful visual or a reading material related to the discussed topic. They were also asked to express their current understanding of the given concepts or ideas. The purpose of this phase was to gain an understanding of students' prior knowledge of the introduced topic and identify any gaps and misconception. This phase of the model was not always implemented as part of class time but sometimes structured as a homework assignment. This invigorated students to be well-prepared and gave them more space for discussion, and executing activities and tasks.
- **In the “Explore” phase**, to ensure students' participation and engagement pair and group work were implemented. This phase is commonly called a “hands-on” experience where students were encouraged to inquire about the topic, give possible answers to raised questions, describe the concepts or explore ideas in their own words without the help of the researcher. With a direct instruction from the researcher, activities, problems and tasks were designed for students to explore extra information and different resources related to the topics. According to this phase, students referred to each other when making sense of the new concept, recording and

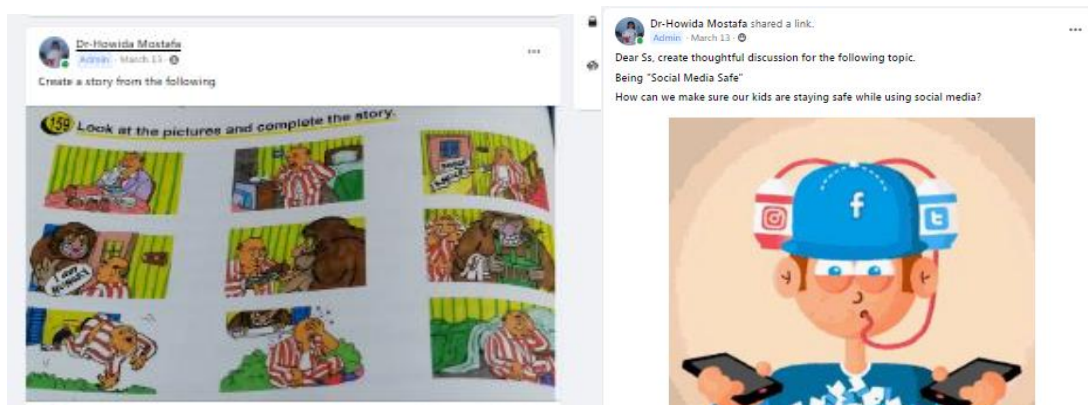
analyzing the collected data, sharing their inquiries and experiences and starting to construct their own initial explanations.

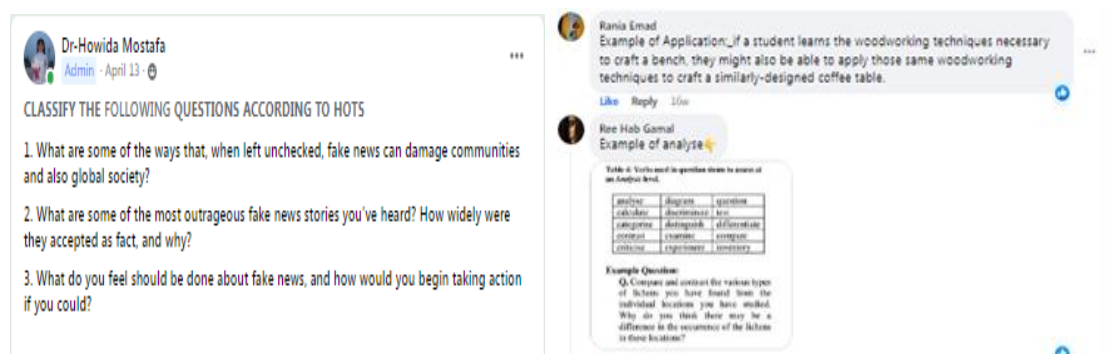
- **In the “Explain” phase**, students were asked to present their thoughts, materials and ideas that they reached in their own words. They were allowed to create different modes of presentation such as PowerPoint, PDF files, oral presentation, and integrate videos over YouTube, visual aids or slide share and photographs related to the given topic and shared it via the Facebook group. In this phase, the researcher led the discussion and asked additional questions to gain more clarification of any confusion or misconceptions. Students were encouraged to find alternative answers to the questions, synthesize new ideas and information and give their own explanations. After presenting students' own explanations, the researcher intervened to directly introduce the technical explanation of the concept to the students.
- **In the “Elaborate” phase**, a deeper understanding was developed by encouraging students to apply the learnt concepts and skills in new situations. The researcher encouraged students to check their own understanding and explanations with their peers and make connections between previous and new gained experiences, ideas and concepts. The purpose of this phase was to let students realize their actual level of knowledge grip and modify their earlier concepts.
- **In the “Evaluate” phase**, students' weaknesses and strengths were diagnosed and they were encouraged to assess their own progress through making a comparison between the current gained knowledge with the previous one. Self-assessment, peer-assessment, writing assignments, and quizzes were included in this

phase to give evidence of achieving the learning goals and outcomes. The researcher provided students with instructive feedback aiming to make any remedial actions.

- Finally, the researcher conducted a summative assessment to address students' complete understanding of the different topics throughout the training.
- Students were also given the opportunity to write their impressions and comments about the training and submit them after finishing the intervention.
- At the end of the intervention, students were undergone through the administration of the post HOTS test and the SDLS scale.
- Data were treated statistically as presented in the next section

The following screenshots present some examples of the treatment:





Results

In order to answer the questions of the current study and in light of the quantitative results of the pre-post administration of the utilized instruments on the participants, the following section deals with the findings in terms of the anticipated hypotheses.

Hypothesis One

The findings of the study revealed that there was a statistically significant difference between means of scores obtained by the participants of the experimental and control group on the post-performance of HOTS test favoring the experimental group. The experimental group achieved a higher degree of improvement as t-value was (28.77) is significant at (0.05) level and beyond. To ensure the effect size of the utilized model, Eta-square (η^2) was calculated and reached (0.920) which is considered high. Additionally, the experimental group achieved a higher degree of improvement on each sub-skill of the post HOTS test compared to the control group as the difference in the mean scores between the experimental and control groups was remarkably high as shown in the following tables:

Table (6) Means, Standard Deviations, η^2 and t-value of Experimental & Control groups in the Post-HOTS Test

No	Group	Mean	SD	DF	T-value	η^2
29	Experimental	35.03	3.33	56	*28.77	0.920
29	Control	16.07	1.01			

* Significance at 0.05 level

Table (7) Means, Standard Deviations, t-value & η^2 between mean scores of the Experimental & Control groups in the post HOTS sub-skills

Domain	Mean Ex.	Mean Cont.	SD Ex.	SD Cont.	T-value	η^2
1. Analyzing	13.86	5.90	1.87	0.661	21.25*	0.890*
2. Evaluating	12.86	6.17	0.973	0.698	29.60*	0.921*
3. Creating	8.31	4.00	1.09	0.643	18.07*	0.900*

*Significance at 0.01 level

Results also revealed that the control group' post administration in HOTS test was slightly improved as the mean of scores obtained in the pre-administration was 15.90 and became 16.07 in the post-administration. Though t-value was (0.321) significant at 0.05 level, but still the experimental group achieved higher scores as shown in (Table (6)). Accordingly, the first hypothesis is accepted and confirmed.

Hypothesis Two

Results pointed out that the difference in the mean scores of the experimental group between the pre and post administration of HOTS test was statistically significant as t-value was (28.88) and Eta-square was (0.954). Moreover, the experimental group got higher marks on each sub-skill in the post-performance of HOTS test compared to the pre-performance as presented in table (9). Accordingly, the second hypothesis is accepted and confirmed.

Table (8) Means, Standard Deviations, η^2 and t-value of Experimental in the Pre-Post-HOTS Test

No	Experimental	Mean	SD	DF	t-value	η^2
29	Pre	35.03	3.33	56	28.88*	0.954
29	Post	15.83	1.12			

* Significance at 0.01 level

Table (9) Means, Standard Deviations, t-value & η^2 between mean scores of the Experimental group in the Pre-Post HOTS sub-skills

Domain	Mean Pre	Mean Post	SD Pre	SD Post	t-value	η^2
Analyzing	5.86	13.86	0.571	1.87	21.65*	0.910*
Evaluating	6.14	12.86	0.776	0.973	28.60*	0.942*
Creating	3.83	8.31	0.530	1.09	19.63*	0.900*

*Significance at 0.01 level

Hypothesis Three

In light of the obtained qualitative results, it is clear that there is a real significant difference between the mean scores of the experimental group in the pre-post administrations in the SDLS scale as t-value was (24.97) and Eta-squared was (0.954) as presented in table (10). Furthermore, results revealed that the post administration of the experimental group in both domains of the SDLS was exceedingly higher compared to the pre-administration. The calculated t-value reached (23.26) and Eta-squared was (0.943) for the Personal Responsibility domain and t-value was (19.94) and Eta-squared was (0.931) for the Autonomy domain as shown in table (11). Thus, the third hypothesis is accepted and confirmed.

Table (10) Means, Standard Deviations, η^2 and t-value of Experimental in the pre-Post-SDLS Scale

No	Experimental	Mean	SD	DF	t-value	η^2
29	Pre	69.55	8.45	56	*24.97	0.954
29	Post	127.28	8.85			

* Significance at 0.05 level

Table (11) Means, Standard Deviations, t-value & η^2 between mean scores of the Experimental group in the Pre-post SDLS Scale sub-skills

Domain	Mean Pre	Mean Post	SD Pre	SD Post	t-value	η^2
Personal Responsibility	35.90	65.83	5.25	4.33	23.26*	0.943*
Autonomy	33.66	61.45	4.51	5.83	19.94*	0.931*

* Significance at 0.01 level

Discussion

In consideration of the study findings, it can be verified that there is superiority of the experimental group compared with the control group as the experimental group scored higher on the HOTS test and the SDLS scale. This superiority and improvement were attributed to the implementation of the Hybrid 5E Instructional Model on the experimental group. Using such a model in the current study was found to be effective and useful for the participants. It had a strong influence on the

achievement of HOTS and the development of SDLS. Using the hybrid training had an impressive impact on the learning process. Face-to-face part assisted the tutor in monitoring and watching students' interactions, communication and gradual enhancement of their level closely. Online learning (sometimes synchronously or as synchronously) gave another positive dimension for the study which formed a favorably atmosphere which stimulated students to work and made them keen on submitting an organized and a creative assignment.

The Hybrid 5E Instructional Model provided students with an enjoyable, a thought-provoking and an inquiry based environment which enabled them to scaffold regularly their learning. Relying on this model in teaching the experimental group, students were given great opportunities to boost their experiences in inquiry which in turn fostered their HOTS. It was also verified that the multifaceted nature of the model helped students to practice mental tasks and activities such as interpretation, analysis, evaluation, explanation, inference, and self-regulation which are key skills of higher order thinking.

In each phase of the Hybrid 5E Instructional model, students were employing different functions and structures which allowed them to explore knowledge, synthesizes information in a meaningful way, construct an understanding of concepts bring ideas together and judge the relevance of each idea to the topic at hand and think critically, creatively and analytically. Students' abilities to develop questioning skills, examine material, make observations, relate previous knowledge with new one, propose answers to different questions and explore sources and tools to gather information were also fostered. The different phases of the model encompassed interactive activities which made students interestingly engaged in discussing and exploring the encountered tasks.

Going through these inquiry based phases, students were able to modify and change misconceptions, to experience failure and learn from their mistakes, analyze material to get its main concepts, generate and organize ideas through discussion, explore alternative ideas, evaluate their own and peer performance, create a new outcome of their own investigations and share it to others. Accordingly, students who used the Hybrid 5E Instructional model phases in their language learning were better achievers and more competent in HOTS compared to others who did not learn via the model. The same results were reached by (Shivam & Mohalik, 2022, Saepuzaman, et al., 2021, Kurratul & Ridwan, 2021) Anggraeni & Suratno, 2021, Masoud, 2021, Agustin, Oktavia & Rahadian, 2020, and Rosli, Ramlee & Saleh, 2019).

Students' reflections and comments supported the aforementioned results as well. The participants of the study referred to their experience to learn using the Hybrid 5E Instructional model of great effectiveness and value. They gained new experiences in each phase of the model pointing to some phases, namely engage and explore, as more challenging where they had to discuss their prior knowledge and discover alternative ideas. Students indicated that all phases of the model were enjoyable, useful and motivating. In these phases, they had the chance to discover their own abilities compared to others, choose suitable aids and materials, justify their explanations and evaluate their own and mates' work as presented in the following comments:

Student (1): *"Really, I enjoyed the training as it was the first time for me to work on this model and construct the data by my own"*.

Student (2): *"For me, I found the first two stages very difficult as I had to test my own information and link it to the new one, but it was interesting because it challenged me to think deeply and give more ideas"*.

Student (3): *"I liked it because it encouraged me to observe my friends' work to evaluate it and change any misunderstanding through discussion before giving explanation"*.

Student (4): *"Although it was not easy, but trying to ask questions and give answers on different materials and evaluate our work each time increased our ability to think not in a normal way"*.

Student (5): *"Through this model, I become able to analyze a lesson or a passage, make questions on it, and prepare it in different types to present it in class"*.

According to the results of this study, the Hybrid 5E Instructional model improved SDLS of the students. It is notable that students' post-performance showed a visible improvement. The students' mean scores in the SDLS scale were significantly increased. It is believed that the meaningful difference created by the model in terms of SDLS aroused from a better organized and comprehensive implementation and from effective use of hybrid training. The inclusion of the Hybrid 5E Instructional model in the current study provided a framework for students to build experiences and gain certain skills which shaped their learning. It strengthened students' ability to work independently, organize work clearly, be willing to receive feedback, communicate effectively with others. Going through the phases of the model provided a systematic cycle for learning. Interactive activities like class presentation, initiating discussion, posing different questions; generating ideas, selecting related resources and conducting self and peer evaluation that were incorporated in the phases of model provided the incentive to be self-directed. In addition to the well-organized learning material and the systematic environment which were provided by the training model in face-to-face or over the web sessions positively influenced their SDLS.

Depicting the inquiry nature of the Hybrid 5E Instructional mode allowed students to regularly make self-reflection on their own learning which is so crucial in developing their SDLS. This type of reflection helped students having an overview of what expected from them, deciding when they need help and judging the adequacy of their explanation and interpretation. Accordingly, the Hybrid 5E Instructional Model was so effective in supporting and encouraging students to be more confident; take on responsibility and be more accountable for their learning behaviors which emphasized their ability to learn autonomously. This result goes in accordance with the findings of (Anshu, Gupta P, & Singh, 2022, Gadicherla et al., 2022, Voskampa, Kuiperb & Volman, 2020, Ibrahim, Marini, & Solihatin, 2018, Cho, Kim, & Choi, 2017 and Akgunduz & Akinoglu, 2016).

This result was also confirmed by students as presented in the following comments:

Student (1): *"The model was interesting as it helped me to gain confidence when showing my work to the class"*.

Student (2): *The organization of the model was useful because I became able to control and manage my knowledge and was able to decide on which tool related to my data I can use (videos, pictures, YouTube).*

Student (3): *"Making reflection in each part of the model helped in knowing our mistakes and trying to think of ways to change and correct them whether individually or with our friends in the group"*.

Student (4): *"For me I liked the part to work at home (Engage) which helped me to manage my task easily and prepare the related information with my own time and pace"*.

Student (5): *"Through the model I improved my ability to accept my friends' viewpoint on my performance; I have control over my own work"*

like thinking of questions, choosing resources, preparing the topic and also choose the way of presenting my work".

Conclusions

The primary sign of quality improvement of learning is the thinking level of students. Providing a meaningful interactive environment proved to have an influential role on enhancing their thinking and independent learning. Therefore, improving HOTS and SDLS should be a priority in language learning among university students to face the of 21st century educational challenges. It can be concluded that the implemented Hybrid 5E Instructional Model succeeded in providing such a motivating environment where students explored, questioned, reacted, and responded to learning material relevant to their needs, choices and interests.

The model proved to be a relevant and valuable tool for giving students the opportunity to promote their HOTS, namely analyzing, evaluating and creating. It was also effective in improving students' SDLS. The study concluded that the use of the Hybrid 5E Instructional Model had a significant impact on enhancing students' performance in both HOTS and SDLS. Undoubtedly, results gained from the quantitative data and students' impressions are clear empirical evidence that the model worked effectively and successfully.

Recommendations

In light of the results of the study, it is recommended that:

- Faculty of Education students should be trained on HOTS and critical thinking to be fit for 21st century requirements.
- Faculty of Education course should encompass activities that lead to developing students' self-directed learning skills.
- Self-directed learning skills should be early introduced to students to become lifelong learners.

- The propose 5E Instructional Model should be incorporated in different courses to foster students' creative and critical thinking.
- Integrating ICT into instruction should be an ongoing process for the valuable impact on improving the learning environment.
- To improve the quality of education, there should be an increase to focus on HOTS

Suggestions for further research

- Investigating the impact of using a Hybrid 5E instructional model on developing speaking and reading skills.
- Exploring the value of using a Hybrid 5E instructional model for enhancing EFL students' satisfaction and self-efficacy.
- Investigating the impact of using a Hybrid 5E instructional model on improving EFL students' engagement and scaffolding.
- Investigating the effect of using a Hybrid 5E instructional model on improving EFL students' academic writing skills.
- Exploring the effectiveness of using a Hybrid 5E instructional model on fostering EFL students' metacognitive skills.

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