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Visual Learning Environment and Analytical Thinking Skills

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Abstract
The study aims to investigate the influence of the visual learning environment on the students' analytical thinking skills. The study hypothesizes that there is no statistically significant difference between the mean score of the experimental group taught visual learning environment and that of the control group which is taught conventionally among students' analytical thinking skills. The study offers an idea for improving students' analytical thinking capacity based on a visual learning environment Three essential elements make up such a strategy: the student, the teacher, and the learning process. One of a teacher's responsibilities is to monitor the learning process by figuring out how to enhance higher-order thinking abilities as effectively as possible. To achieve this aim, the study used a non-randomized pre-post-test experimental design. The evaluations of the students' analytical thinking test produced the data. Consequently, two random groups are selected to take part in the experiment. The experiment group consists of (40) students using a visual learning environment, whereas the control group includes (40) students using a traditional approach. Additionally, the researcher used the analytical thinking skills exam to compare visual and conventional teaching methods, and they also gave the pretest and posttest analytical skills. According to performance analysis, using visual learning aids improved students' capacity for analytical thinking. This research provides significant insights into the effect of the visual learning environment on students' critical thinking skills. It forms a basis for future work in education and further investigations of visual-oriented learning strategies.

Keywords: Analytical thinking skills, educational innovation, experimental design, traditional teaching methods, visual learning environment
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Introduction

The study presents an approach to education focused on visual stimuli and may be presented visually. Teachers and students can benefit from using the visual depiction of the environment in their teaching and learning. Students with analytical thinking abilities grow in their capacity for higher-order thinking (HOT) and teamwork. Thinking analytically comes in a variety of forms. Ordering, comparing, contrasting, assessing, and selecting are examples of analytical or logical thinking skills. They support the reasoner in choosing the optimal option by utilizing critical thinking. (Rodger et.al. 2009). The proposed approach aims to study the role of a visual learning environment based on improving students' analytical thinking skills.

However, developing analytical thinking in college students requires several things, so it's not a simple process. According to Budsankom et al. (2015), a student's high-order thinking skills are influenced by various factors, including the classroom environment and their intellectual and psychological makeup. Thus, creating an analytical learning environment in the classroom requires the preparation of both the instructor and the students. Simply put, educators should create a setting in the classroom that encourages the growth of critical thinking abilities. In order to better manage the goals of the learning environment and succeed academically, students should also practice on their own to hone their analytical skills.

Numerous studies demonstrate that courses that visually provide material help students learn. The researcher presents an engaging learning environment for the classroom that encourages using visual aids including flowcharts, diagrams, pictures, and interactive simulations to communicate knowledge. The majority of the information that the human mind processes comes from visual sources. Additionally, learners' mental maps of visual information are superior (Williams, 2009). The integration of knowledge from visual media is known as visual learning. When presented visually, material in the classroom is easier for students to grasp. There are many ways to deliver visual information, including through pictures, flowcharts, infographics, movies, games, cartoons, coloring books, slide shows/PowerPoint decks, posters, flashcards , slide shows/PowerPoints decks, posters, movies, games, and flashcards (Rodger et.al. 2009).

These restrictions can be circumvented via graphic input materials, which encourage the use of a number of "higher order thinking skills." Given that the creation of a visual representation requires thinking and clarity, graphic input material may also help someone grasp a subject better. Receiving the information causes the mind to continue working, and while it does, the person will have more time to consider the message carefully, so indirectly honing latent thinking abilities. Helpful visual cues provide pupils a stimulus that is simple to notice and enable them to establish a connection between what they are seeing and what they are learning. This supports the involvement of 'third level thinking skills' (thinking, inferring, and assessing), and also the absorption of the authentic underlying thinking abilities (understanding, application, analysis, synthesis, and assessment) in the learning process. Because the VLE may provide a variety of material, including photos, slideshows, music, video, 3D animation, and virtual simulation tools, it can help EFL students develop and foster critical thinking abilities.

The study aims to investigate the influence of VLE on the students' analytical thinking skills. The research posits that there is no meaningful statistical difference between the average score of the experimental group receiving VLE instruction and that of the control group undergoing traditional teaching methods concerning students' analytical thinking abilities. An overview of the study on the domains of the visual learning environment, the analytical thinking talent, and earlier investigations is provided in this part.

Literature Review

Context of the Research Education is crucial for personal transformation in the complex and rapidly evolving global society. Learners now use aural and visual learning modalities in addition to the more conventional spoken communication style. Many academics and theorists, like Piaget, Vygotsky, and Bruner, concur, arguing that visual aids play a crucial role in knowledge reconstruction, providing information in various ways, promoting memory, and improving comprehension. Students nonetheless frequently turn to conventional teaching methods despite these advantages. It is advised that educators use both spoken and visual instructions in their pedagogies. Consequently, it is advised that educators incorporate both spoken and visual instructions into their pedagogies. Instructors' proficiency in employing visual support should also be actively and continuously developed through teacher-training programs. This article investigates how visual learning environments affect EFL undergraduates' ability to analytical thinking. The function of visual learning environments in promoting self-directed student learning is covered in the study (Archambault et al., 2022). The paper discusses the role of visual learning environments in encouraging independent student learning.

A literature review on the long-term impacts of Visual Learning Environments (VLE) on students' capacity for analytical thought is conspicuously lacking. Little is known about how these skills develop over time or how VLE might differ for students at different academic stages or in different circumstances, even though this study compares the immediate results of utilizing VLE. Furthermore, while this study primarily compares VLE with traditional methods, it does not consider factors such as student motivation, learning styles, and how VLE can be combined with other teaching methods (such as blended learning) to enhance critical thinking.

Visual learning environment

Students may improve their visual thinking skills by using a visual learning environment. Visual thinking is a type of learning where knowledge is better understood and retained by the learner when ideas, words, and concepts are associated with visuals. Information about the visual environment is given using a variety of interactive visual tools, including 3-D visual environments and information and communication technologies (like web services). This study contributes to the evaluation of visual thinking abilities. Since it discusses learning from visuals as well as research on the creation of visual aids and learning materials for use in college classrooms and other educational settings, this falls under the category of theories that are the most complicated. Dwyer was the first to exploit visual learning as meaning research (1972, 1978). Furthermore, Fleming and Levie (1993) presented message design principles for the designing instructional visuals based on behavioral approaches for designers and educators.

Learning through the analysis, creation, interpretation, and reading of pictures, symbols, icons, and other visual input is known as visual learning. When used with three-dimensional objects and time, it's sometimes called spatial learning or visual-spatial learning. Verbal instructions written on the whiteboard do not constitute a form of visually language or communication on their own. When straightforward but relevant drawings or pictures are added to spoken instructions, visual instruction can start. It goes on when text and visual components coexist in a graph, diagram, or text that has been illustrated, such as in a picture book or graphic novel (Mahanani, et al, 2022).

As teachers and students gain more awareness of visual teaching and learning, chances to integrate visual tactics into curriculum and classrooms will present more creative atmospheres. Students may access and share previous information, expand their vocabulary, acquire new concepts, generate ideas, and improve higher-order thinking skills through visual learning and teaching.Visual thinking facilitates the formation and exchange of ideas by assisting pupils in seeing links, patterns, and relationships (Nwabude ,et al, 2020).

This study attempts to clarify how these visual learning aids facilitate the development of critical thinking abilities in EFL students, given the impressive results of previous research (Toleuzhan, 2022). This study will focus on higher education students who often require analytical abilities by absorbing visually rich information, using the same comparative approach. A variety of graphically enhanced learning resources, including click-through annotative slides, animations, simulations, and quizzes, will be used to encourage their critical thinking. Through the placement feature of these visually-supported questions and their insightful feedback answers, students will be encouraged to think more deeply and methodically, which will help them realize insights related to subject areas both individually and collectively. These effects come from both the practical educational demands that are there and the capability of these instruments in the realistic educational needs that are collaboratively proven through ELT course materials.

Analytical thinking skills

One of the key competencies for learning in the twenty-first century is the ability to think analytically. Data analysis is a fundamental ability in information processing. It assists students in distinguishing between a set of data that may be helpful to them in their learning processes and unhelpful data (Elder & Paul, 2019). In scientific classrooms, where information evaluation is a necessary part of every learning process, this ability is expected of students. More analytically inclined students could formulate sensible hypotheses, use methodical experimental techniques, and, supported by data from science, come to a definitive conclusion (Santos, 2019). It follows that learning ability in the classroom is often higher for students who possess strong analytical thinking skills.

Analysis is ranked in the top three along with synthesis and hierarchy assessment in Bloom's (1956) Taxonomy of Information Processing. It may be inferred from this that a student with a more developed cognitive process could first examine, summarize, and assess the data before acting. One may argue that the abilities of data analysis, synthesis, and assessment include analytical thinking skills (Kennedy et al., 1991).

An individual's methods for handling situations and information can also serve as examples of analytical thinking. An analytical thinker, for instance, should be able to evaluate arguments, claims, and supporting data by concluding deductive or inductive reasoning. They should also be able to use these conclusions to make decisions and solve problems (Choowong & Worapun, 2021; Ennis, 1985; Facione, 1990; Willingham, 2007) .

To characterize analytical thinking, Art-in (2017) offered three dimensions: analysis of elements, analysis of links, and analysis of organizational principles. To explain, students should be able to identify implicit beliefs, tell facts from theories, understand how ideas relate to one another, spot logic errors in evidence, identify an instructor's point of view in a historical account, etc. These skills are important in science studies as students need to learn to set hypotheses, evaluate data to utilize appropriate experimental elements, systematically analyze and synthesize results of the experiments, and logically present and evaluate them.

Related Research

The role of visual learning in enhancing students' higher order thinking abilities was covered by Raiyn (2016). The goal of his research is to offer an engaging teaching approach that encourages the use of visual aids like flowcharts, diagrams, pictures, and interactive simulations to convey knowledge to students. In addition, he examined the HOT skills of visual and conventional learners, assessing them with the SWOT model. According to performance analysis, students' HOT abilities improved when they used visual learning aids. environment for visual programming. It is a teaching tool for object-oriented programming that lets users build interactive games, animations, and films. Ichsan Sigit and Miarsyah (2019). an evaluation of environmental learning demands based on higher-order cognitive abilities. The purpose of this study is to evaluate the needs of the learning resources, instructional materials, worksheets, and learning assessments used in college and university courses. The study was conducted from November 2017 to January 2019 at several schools in Bekasi and one institution in Jakarta. The research approach used is descriptive, and the techniques for gathering data include interviews and observation. The results showed that all media learning, instructional materials, learning materials, student worksheets, and learning evaluations at various levels were built upon the HOTS. The study's findings indicate that while HOTS-based learning has been used in environmental education, environmental education is still in use HOTS-based learning has been implemented in senior high school and universities.

Astuti, Sugiyarto, and Ikhsan (2020) used a quasi-experimental posttest approach to examine the effects of visualization on students' scientific attitudes and critical thinking abilities in chemistry. Students' scientific attitudes were measured using a questionnaire that was developed from many books and periodicals, and their critical thinking abilities were measured using a chemical bonding test. A total of ninety-six grade 10 pupils from Gonangium Regency, Yogyakarta, Indonesia's senior high school were chosen at random into clusters. Class CG used a wet laboratory; Class EG-1 used a virtual reality laboratory integrated hybrid learning; and Class EG-2 used both of them. The samples were divided into these three classes. The MANOVA test revealed that pupils who made use of 3D visualization had better results in critical thinking skills and scientific attitudes.

Recent research from 2023 and 2024 has explored the impact of Visual Learning Environments (VLEs) on the analytical thinking skills of English as a Foreign Language (EFL) undergraduates. One notable study by Liu and Wang (2024) examined how Artificial Intelligence (AI) tools influence critical thinking in English literature classes. Their findings showed a significant improvement in the critical thinking abilities of students who used AI tools compared to those who didn’t. This suggests that AI can be an effective tool for enhancing analytical skills in literature-based learning.

Similarly, Luan et al. (2024) investigated the role of Virtual Reality (VR) technology in vocabulary learning among college-level EFL students. In their study, 68 students were divided into two groups: one interacted with a self-developed VR platform, while the other watched traditional instructional videos. The results showed that students in the VR group performed significantly better in vocabulary acquisition. This highlights the potential of immersive VR environments to create more engaging and interactive learning experiences by providing real-time feedback and authentic language exposure.

Ma and Chen (2024) took a different approach, focusing on how AI-powered applications affect student engagement and procrastination. Their study assessed the impact of AI on cognitive, affective, and behavioral engagement, as well as its role in reducing academic procrastination. The

results indicated that AI tools not only improved student engagement but also helped minimize procrastination, making them a valuable addition to modern EFL classrooms.

Methodology

An outline of the procedures used in this study to examine how teaching in a visual learning environment affects students' analytical thinking abilities was taken from the literature and theory. This includes the experimental design, population and sample, equalization of the experimental and control groups, instructional materials, and research instrument.

Study design

To achieve the aim of the current research, a non-randomized pretest-posttest control group design was used in the experiment. A nonrandomized control group pretest-posttest strategy is used to investigate the study's hypotheses. Two groups are randomly selected to be the first control group, which follows the dependent variable of traditional instruction while experimental group receiving instructions in a visual learning environment (VLE) to observe the impact on the students' analytical thinking abilities as the independent variable.

Population and Sample of the study

In the second semester of the 2024 academic year, 169 undergraduate students made up the research population. The participants in the study were second-year undergraduate English language learners from the University of Baghdad's College of Education. The main investigator for this study tested 80 undergraduate students over the course of six weeks, from 13 March 2024 to 27 April 2024. The students were split into two groups: the experimental group (B) had 40 students who were exposed to VL environment, and the control group (A) had 40 students who were randomly selected and exposed to traditional teaching methods. The two groups took the Analytical Thinking Skills exam before to and following visual learning environment.

In this study, the two groups are equalized in terms of the students' ages, the mother and father's educational backgrounds, and the pre-test scores. The equalization of the two groups at the mother and father's academic level is calculated by the Chi-Square values at the significance level of (0.05). The T-Test values in the students' age range and the pre-Test statistical analysis of equalization between two groups show that all variables are non-significant at the significance level of (0.05).

The pre-test was finished by students in both the experimental and control groups, and the t-test formula for two independent samples was applied. The experimental group's mean scores are (12.874), whereas the control group's mean scores are (11.551). The two groups' respective standard deviations are (3.301) and (3.671). At a significance level of (0.05) and (78) degrees of freedom, the computed t-value (0,694) from the t-test for two independent samples is smaller than the tabulated t-value (2.00). The findings indicate that there is no statistically significant difference in the pre-test scores between the experimental and control groups. as shown in table (1)

Table 1. *The T-Test Value of the Two Groups in the Pre-test*

Group	No. of Students	Mean	Std	T – value		D.f	Sig.
				Computed	Tabulated		

Control	40	11.551	3.671	0,694	2,00	78	0.05
Experimental	40	12.874	3.301				

Research Instrument

The tool for this study was a pre-posttest on analytical thinking skills. It was provided to both groups following fifteen weeks of intensive English language instruction, consisting of three courses each week. The experimental and control groups are given instructions in VLE to take a four-question test. Teaching and providing a visual learning environment for the students constitute the initial instructional phase. To help teachers apply visual learning, a variety of visual learning environments for knowledge exchange have been built.

There are twenty objective question items in the analytical thinking test. Using significance analysis, relationship analysis, and principles analysis—the three main components of analytical thinking—the researcher developed a set of questions to assess students' analytical thinking skills. The following are the questions: (5) Multiple-Choice Questions for Numerical Reasoning, (5)T/F item Logical Reasoning, (5) Matching Spatial Reasoning items, and MCQ (5) Data Interpretation items. Skills covered include verbal reasoning, numerical reasoning, data visualization, data sufficiency, critical thinking, and problem solving.

Validity

Face validity is the degree to which an instrument evaluates the data it intends to assess (Mills & Gay, 2019). A jury of specialists, including six university professors and supervisors of English language teaching, validates the study's face validity by examining the pre-post examination. The jury approved the face validity of the instrument and gave great input, obtaining correct opinions about the appropriateness and sufficiency of the items.

Pilot Administration

A pilot administration of the research instrument was carried out to verify that the components and instructions were clear. The amount of time needed to administer an instrument was also calculated. 50 second-year students from Baghdad University's College of Education for Women who were not included in the initial sample were chosen at random to take part in this administration on March 14, 2024. The results of the pilot administration indicated that there is no substantial doubt regarding the offered items and the instructions, and that the time allotted to perform the analytical test ranges from fifteen to twenty-five minutes.

Following the scoring of test papers, the results are sorted from highest to lowest. The scores are then split into two groups: the highest 27% of the scores form the upper group, while the lowest 27% of the scores form the lower group. Each group contains (20) points. This is done to verify the degree of difficulty and discriminating ability of every test item. The Discriminating Power Index of Item Objective, which measures analytical thinking abilities, varied from(0.60 to 1.0)and had a difficulty range of (0.20 to 0.70).

Reliability of the Study Instruments

According to Gay et al. (2012, 144), reliability is the "degree in which a test constantly defines whatever it is meant to assess." The test's reliability is evaluated using the Alpha-Cronbach approach, and the results show that all of the questionnaire's items are dependable and consistent (rated at (0.88)). The test's reliability is further evaluated using the Kuder Richardson Formula 20, yielding a score of (0.89). The test's question items are taken from student materials titled "Teaching English as

a Foreign or Second Language" by Gebhard (2009).

The Teaching Material for Visual Learning Environment

To provide the visual content, the instructor chose a lesson in a visual learning environment and the appropriate learning resources. The teacher led a conversation, asked questions, and responded to student feedback after introducing the chosen lesson until all objectives were met. The visual task was given out by the teacher. The teacher went on to evaluate and simplify the learners' visual learning ability. When compared to a traditional learning method, it is evident that the usage of visual aids has improved students' capacity for critical thought. Compare the visual analytical thinking skills in the visual learning process with the standard analytical thinking skills by choosing two groups. In addition to photos, slideshows, music, video, 3D animation, and virtual simulation tools, VLE may offer a variety of media formats. It may foster an excellent, in-depth learning environment by picking students' curiosity about what they are studying and encouraging them to think critically and analytically. It gives learners the chance to locate, arrange, assess, and create knowledge. In PowerPoint slides and other relevant notes that students must install and open in order to access the contents during the course, the instructor might assemble pictures, animations from online resources, and link them to the class. Throughout the session, students can access the resources that the teacher has prepared. Students can adopt more flexible and diversified thinking patterns by dismantling the inflexible classroom thought process with the help of the VLE. Following the conversation, the instructor has the option to gather and archive the outcome for the teaching tool. It is also easy to be extended, not only for the lesson but also can be used in the class project.

Final Administration of the Post–Test

After validity and reliability assessments, on April 27, 2024, the experimental and control groups get the same administration of the post-test on analytical thinking abilities.

Scoring the Post–Test

Questions of the analytical thinking skills post-test scoring scheme are each correct item is allotted (1) score and incorrect one(0) score ,as in the following:

1. Question 1(5 scores): Five MCQs for Numerical Reasoning items,
2. Question 2 (5 scores): Five T/F items for Logical Reasoning,
3. Question 3 (5 scores): Five Matching items for (5) Spatial Reasoning, and
4. Question 4 (5 scores): Five MCQs items for (5)) Data Interpretation.

Results

This section explains the data analysis and how the results relate to the purpose and hypothesis of this study. The present study employs the Two Independent Samples T-test to investigate the hypothesis that "there is no statistically significant difference between the mean score of the experimental group which is taught VLE and that of the control group which is taught conventionally among students' analytical thinking skills." This will enable the study to fulfil its stated goal, which is to "investigate the influence of VLE on the learners' capacity for analytical thinking".

The data collected is from the T-test for independent samples after the post-test is given to both groups to determine the statistical differences between the control and experimental groups, as shown in Table (2)

Table 2. *Two Independent Samples T-Test of statistical differences between two groups in Analytical thinking skill posttest*

Group	No. of Students	Mean	Std	T – value		D.f	Sig.
				Computed	Tabulated		
Experimental	40	16.052	1.681	8.450	2.00	78	0.05
Control	40	12.474	1.989				

The study's findings show statistically significant differences between the Experimental and Control groups, demonstrating the impact of the visual learning environment on students' capacity for analytical thinking. Based on t-test, the experimental group's performance ($\bar{x}$ = 16.052, S.D. = 1.681) was significantly higher than the control group ($\bar{x}$ = 12.474, S.D. = 1.989). It concluded that learning was helpful in the development of students' analytical thinking based on the calculated t-test = (8.450), which is higher than the tabular one (2.00) for degree of freedom (78) at a significance level (0.05).

Discussion of the results

Thus, the study's findings explore how ELT undergraduate students' analytical thinking is impacted by their visual learning environment. Examining the post-test results of the student analytical thinking skills between the experimental and control groups, it was found that the experimental group's learning achievement scores were statistically significantly higher than the control group's, with a significance level of (0.05). In agreement with Raiyn (2016), Ichsan, Sigit, & Miarsyah, (2019), and Astuti, Sugiyarto, & Ikhsan, (2020), visual learning aids have been found to enhance students' HOT abilities, allowing them to practice critical thinking and express their viewpoints. and provide students the freedom to study whenever and wherever they choose, as well as the opportunity to interact and connect with lecturers via visual media. Using this setting enhances students' ability to expand concepts beyond the text. It creates a welcoming, safe, and supportive learning environment. Students are encouraged to take risks and attempt new things in this environment. They will feel more at ease expressing their opinions as they won't be scared of receiving a negative response.

Conclusion

Based on the findings, it can be concluded that students' development in a visual learning environment can lead to an increase in analytical thinking skills. By dividing the class into smaller groups, the visual learning environment was utilized to assess and discuss the performance of the students as well as their decision-making skills. Compared to traditional learning approaches, visual learning yields superior results. The development of students' analytical thinking abilities is greatly impacted by visual learning in college students. Students can comprehend the majority of information provided visually, therefore having a visual learning environment is crucial. Learning with visual aids is considered to be beneficial, particularly for inquisitive pupils who can practice and exhibit the techniques used in visual learning. An environment that causes kids to employ crucial traits such as critical thinking skills.

High-order thinking skills are crucial for ELT lessons, according to this, since they enable students to rationally assess data to formulate sound hypotheses, carry out experiments, and report their

findings. It is not surprising that the students in the current study were able to gain learning environments in the development of analytical thinking abilities because these processes are crucial to learning ELT.

By utilizing our intrinsic capacity to digest visual information more quickly and efficiently than text alone, visual learning is a teaching method that uses graphics to communicate information. This approach leverages the cognitive process by which students acquire knowledge using visual aids, making it an essential tactic for educators to improve comprehension and memory of content.

Recommendations and Suggestions

In light of the results and conclusions, the following suggestions have been made: Making pupils interested in and actively participating in the learning process is one of the major challenges that teachers confront in the teaching and learning process. Teachers can facilitate learners' understanding of learnt abstract knowledge by establishing a visual learning environment.

The suggested learning environment model is also advised for usage as a student-centred teaching strategy in the classroom to enhance analytical thinking and learning. With a student-centered approach, students are more involved in choosing how they will learn. Teachers still, however, have a significant role to play in assisting students in meeting their learning objectives by serving as informational proxies. Every step of the learning activities is assisted, encouraged, and guided by the teacher. This is particularly crucial if the student is unmotivated to study or is unable to comprehend the goals of the prescribed learning plan.

To maximize the effectiveness of learning styles, teachers should conduct a comprehensive analysis of the curriculum, the setting, and the preparedness of their students .

When making recommendations for new projects, we'll take into Researchers ought to test the suggested analytical thinking skills learning on students in various settings, such as departments and learners at different levels. To help learners improve their skills in other areas as well, this learning paradigm should be examined. Investigating how using VLA affects students' success in developing other higher-order thinking abilities like assessment or critical thinking is also advised.

It is suggested that research be done to find out how the VLA technique influences EFL students' motivation and level of involvement when learning the language of analytical thinking abilities.

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