

Using a DDL Based Program to Develop EFL Reading Comprehension Skills and Spatial Thinking among Geography College of Education Freshmen

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Abstract

The current study investigates using a DDL based program to develop EFL geography freshmen reading skills and their Spatial thinking. The participants included 30 freshmen of the faculty of Education, Menoufia University. The researcher prepared a reading comprehension pre-posttest, reading skills checklist, a DDL based program, a teacher's guide, and spatial thinking skills checklist. The study group was taught during the first semester of the academic year 2022/2023. Findings proved that there are statistically significant differences after using a DDL based program.

Keywords: *a DDL based program, EFL reading skills, spatial thinking, EFL geography freshmen*

Introduction

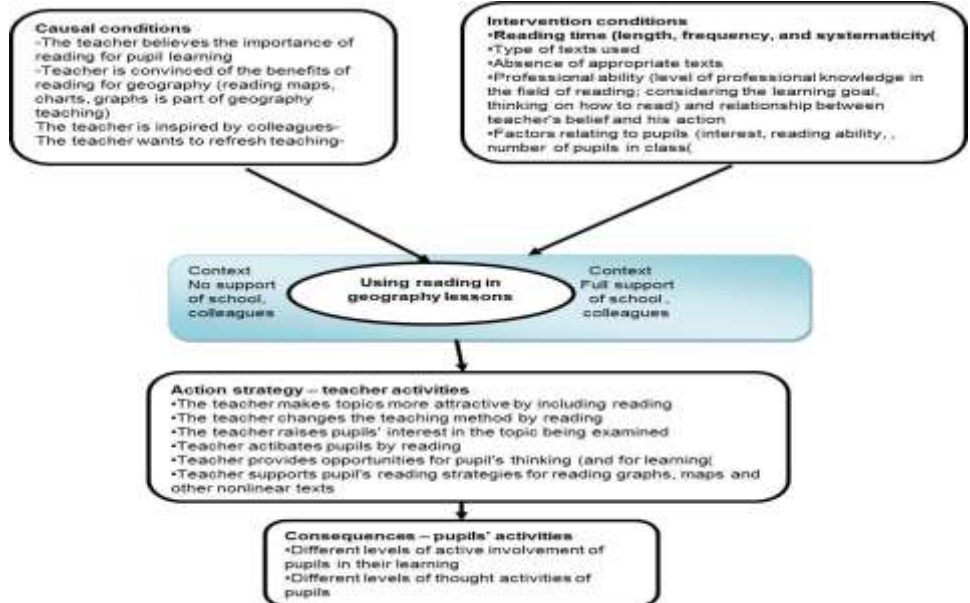
Integrating EFL reading skill with geography is a very important step to learn new concepts, improve the communication process, and unify the subjects together to make the learning process more precise and achieve the goals of the connectivity between the subjects. Reading is a receptive skill which needs an art of acquiring the data and dealing with the new texts that contains many information specialized in geography.

"Any subsequent reading to that knowledge" is improved by improving content understanding (McKenna

& Robinson, 2005, p. 168). Furthermore, students find a topic more interesting when teachers make connections between new information and what they already know about it. This increases the students' desire to read the material (Brophy & Alleman, 2002; Doty, Cameron, & Barton, 2003; Good & Brophy, 2000; Irvin, Lunstrum, Lynch-Brown, & Shepard, 1995). It may be possible to boost reading achievement and spark readers' attention by relating geography to literacy abilities.

Not teaching these areas will limit students' prior knowledge on many things they may read about, which is counterproductive if the goal is to improve reading achievement. Because comprehension of what one is reading requires sufficient background knowledge, inadequate training in these areas may eventually have a negative impact on students' reading achievement (p. 685).

Fig. 1 Paradigm model "The inclusion of reading in geography instruction", 2020



Due to the geographic nature, its data are a unique kind. The geographic data are spatially related, allowing us to use a spherical coordinate system (latitude and longitude) to locate and identify features. They consist of both pictorial and descriptive aspects that describe what they are, where they are found, and how they are related to one another spatially. While the graphical components are typically referred to as geographical data, the descriptive aspects are typically referred to as non-spatial data. Geographical data are always relevant to Earth's resources and characteristics, as well as human activities that are dependent upon or related to these resources and features. Geographically-related problem solving and decision-making, such as determining location, distribution, and spatial relationships within a certain geographic framework, are the main goals of gathering and using geographical data.

However, geographic information is obtained through the processing of geographic data. The user's understanding of the geography of the Earth's resources and features, as well as the human activities connected to these resources and characteristics, can be enhanced by the geographic information. In order to solve problems and make decisions about the occurrence, use, and conservation of Earth's characteristics and resources as well as the effects and repercussions of human activities related to them, it helps users to acquire spatial intelligence.

Since geographic data has a spatial nature and other unique qualities, general concepts of information organization and data structure cannot be immediately

applied to it. There are three dimensions to geographic data, which are listed as time-wise and thematically and spatial. GIS emphasises the use of spatial dimension for turning data into information which assist our understanding of geographic phenomena.

DDL is used to provide students with large quantities of high-quality linguistic data from actual communicative behaviors in order to improve their reading comprehension of geography. To put it briefly, data-driven learning can help students learn authentic language by providing them with a real-world setting in which they can hone their linguistic intuition and experience handling linguistic variety (Zhen, 2005).

More broadly, using DDL helps students pick up (or at least hone) a variety of critical learning skills. Predicting, observing, noticing, thinking, reasoning, analyzing, interpreting, reflecting, investigating, drawing conclusions (deductively or inductively), concentrating, guessing, comparing, differentiating, theorizing, hypothesizing, and verifying are among the skills listed by O'Sullivan (2007: 277). Although these are general cognitive talents, they can be used not only to language exploration but also to other areas of study.

Context of the problem

The researchers observed that the geography college of education freshmen have a lack of EFL reading comprehension skills and spatial thinking in geography which needs to expand their information and geographical data through the researchers' work in faculty of education.

Previous studies such as (Golledge, R& Marsh, M, 2007, Catling, S, 2001) assured that students have problems in reading geographical contexts in the English language. In most cases, they have problems with synonyms, antonyms, guessing omitting words, visualizing the reading texts on maps and understanding new geographical concepts because of using the traditional methods in teaching subjects separately and not linking between different subjects.

The researchers conducted a pilot study to document the problem. It aimed at measuring students' performance level in reading comprehension and spatial thinking skills and determining which subskills they have difficulty in. The test measured reading subskills (literal comprehension – inferential comprehension – creative comprehension) and spatial thinking subskills (interpreting information – asking questions related to the place – determining spatial preference – changing overtime). The results of the test proved geography college of education freshmen's weakness in reading comprehension and spatial thinking skills. The test's results are summarized in the table below.

Table (1) Results of reading comprehension skills pilot study (n = 20)

Skill	Means	Std. Deviation	Medium	Skewness
Literal comprehension	1.84	0.92	2	-0.725
Inferential comprehension	1.43	0.64	1.5	0.804
Creative comprehension	1.85	0.85	2	-0.614
All Reading comprehension	5.12	1.21	5	-0.589

Table (2) Results of spatial thinking skills pilot study (n = 20)

Skill	Means	Std. Deviation	Medium	Skewness
Interpreting information skill	0.95	0.41	1	-0.62
Asking questions skill related to the place	1.24	0.70	1.5	0.701
Determining spatial preference	0.95	0.53	1	0.623
Changing over time	0.47	0.26	1	-0.147
All Spatial thinking	3.61	0.96	4	-0.431

Statement of the problem

The problem of the current study could be stated in the weakness of both EFL reading comprehension and spatial thinking skills. that is why; the current study investigated the effectiveness of using a DDL based program to develop EFL reading comprehension skills and spatial thinking among geography college of education freshmen.

Aim of the study

The current study aimed at developing EFL reading comprehension skills and spatial thinking among geography college of education freshmen through using a DDL based program.

Questions of the study

The current study attempted to answer the following questions:

- What are the EFL reading comprehension skills that should be developed among geography college of education freshmen through using a DDL-based program in teaching the English language course?
- What are the spatial thinking skills that should be developed among geography college of education freshmen through using a DDL-based program in teaching the English language course?
- What is the effectiveness of using a DDL-based program in developing EFL reading comprehension skills (literal comprehension– inferential comprehension– creative comprehension)?
- What is the effectiveness of using a DDL-based program in developing spatial thinking skills (Interpreting information
- Skill - Asking questions skill related to the place - Determining spatial preference - Changing over time)?
- What is the correlation relationship between EFL reading comprehension skills and spatial thinking among geography college of education freshmen?

Significance of the study

- The present study is significant as it might help:
- Freshmen: as it helps them to develop their EFL geography reading skills and spatial thinking.
- EFL teachers: as it helps them to integrate the subjects in an interactive way through using a DDL based program.
- EFL curriculum: as it facilitates to develop the methods of teaching English for EFL Geography freshmen reading skills.

Hypotheses of the study

- There is a statistically significant difference at the level of (0.05) between the mean scores of the experimental group in the pre-posttest of EFL reading comprehension skills (literal comprehension – inferential comprehension – creative comprehension) in favor of the posttest.
- There is a statistically significant difference at the level of (0.05) between the mean scores of the experimental group in the pre-posttest of spatial thinking skills (interpreting information skill – asking questions related to the place – determining spatial preference – changing overtime) in favor of the posttest.
- There is a positive correlation relationship between students' scores in EFL reading comprehension and spatial thinking skills.

Delimitations of the study

- A group of 30 EFL geography college of education freshmen, Faculty of Education, Menoufia university.
- Some EFL reading comprehension skills including (literal comprehension– inferential comprehension– creative comprehension).
- Some spatial thinking skills including (Interpreting information Skill - Asking questions skill related to the place - Determining spatial preference)
- The first semester of the academic year 2022/2023.

Terms of the study

A program based on DDL

It is "an approach that provides a structured, scaffold framework for inductive learning," according to (Smart, 2014). DDL methodology uses corpora to enhance language learning and instruction.

The current study defined it is a program based on data-driven learning according to sequential steps starting from hypothesis formation through inductive DDL tasks with hands-on tasks, explanations from the teacher to confirm or correct these hypotheses, follow-up exercises (homework) and teacher feedback on homework, and production through follow-up exercises (in class) and teacher feedback on homework to develop EFL Geography Freshmen Reading Skills and Their Spatial Thinking.

Spatial thinking

It is the capacity to identify spatial patterns and distributions, to link places, to understand and apply spatial hierarchies, to regionalize, to orient to physical frames of reference, to imagine maps from spoken descriptions, to sketch maps, to compare maps, to overlay and dissolve maps, and so on. (Bednarz, R, Lee. J, 2011)

The current study defined it as a set of intellectual skills that shed the light on a number of questions that contribute building spatial knowledge and interpreting information that supports choosing the appropriate place and its development over he time.

EFL reading comprehension skills

Reading comprehension is an active cognitive activity that requires using reasoning to derive meaning from written material and comprehending it completely (Nakamoto, Lindsey, & Manis, 2008).

The current study defined it as a group of intellectual processes that include understanding the meaning of the written text and interpreting information to reach the

explicit meaning to produce unique creative textual compositions enabling EFL learners to deeply and adequately understand the written language, necessitate teaching them the reading comprehension skills that comprises reading proficiency.

Review of Literature

Reading comprehension is one of the fundamental skills in any language. It is the center of the foreign language learning curriculum because true understanding happens when readers combine their thoughts with the text, ask questions, draw inferences, think about what is relevant, summarize and synthesize, enabling them to use their understanding to ask more questions and direct new learning (Elghotmy,2018). In this dynamic process, the reader builds meaning by communicating with text using his previous knowledge and experience and the details that can be found in the text. The more context information about the text that the reader has, the easier it is for him to understand the text (Aghasafari and Aziz,2015,p.149).

2.1.1 Purpose of reading

People read for a variety of reasons and for varied objectives. They read for enjoyment, to learn specific information, or to comprehend the overall meaning of a piece. Many people use reading as a way to learn things from written materials. Pupils are instructed in reading to enhance their language skills and cultivate an awareness of the significance contained in texts. Reading is a participatory experience in which the reader makes use of the information presented. Based on his or her prior

knowledge as well as information obtained from the page that is printed. Reading is also interactive in the sense that many people participate in it. In the process, different skills operate together at the same time. (Helwa, 2014).

Gaining insight and understanding from the written words is the goal of reading. In order to employ comprehension strategies, the reader must understand what the study indicates about the active process of learning meaning. Reading should be done with the intention of developing present communication into something the reader can communicate in the context of their own real life (Sangia, 2018). Positive improvements will result from the message if there is significant communication between the writer and reader, as this will foster a tight relationship. The reader can always enforce the knowledge they have learned from written texts, which will make the relationship more organic.

Types of reading

According to Harmer (2001), reading can be divided into two categories: extensive reading and intensive reading. A type of attentive reading known as "intensive reading" is usually serious, intent, and dedicated to a specific academic accomplishment.

On the other hand, reading extensively is a more leisurely activity that is typically done for enjoyment or amusement. In this type of reading, students typically read novels, novelettes, or lengthy stories outside of the classroom in the resource center, library, and other learning spaces. In this type of reading, students typically read

novels, novelettes, or lengthy stories outside of the classroom in the resource center, library, and other learning spaces. In ideal teaching conditions for EFL reading, students should have access to both extensive and intensive reading assignments.

MODELS OF EFL READING

- Among a multitude of scholars studying EFL reading, the bottom-up, top-down, and interactive reading models are the most widely used.
- In the first model, readers follow an instinctive pattern that leads them to construct a piecemeal mental translation of the text's content, with little help from their schemata. This also applies to the partnership.
- between phonemes and graphemes (Dubin & Bycina, 1991), syntactic parsing (Grabe & Stoller, 2019), and word recognition skills.
- The top-down model in EFL reading appears shortly after the bottom-up model's demise. This second paradigm emphasizes understanding of more significant parts and views reading as a process of recreating meaning.
- past phrases, sentences, and words (Dubin & Bycina, 1991).
- According to this approach, readers are engaged participants who establish their own objectives and standards.
- They could partake in reading exercises including speculating on the meaning of terminology from the context, deriving conclusions, anticipating the text using prior knowledge, and locating pertinent information in the text (Grabe & Stoller, 2019).

- The last reading model, the interactive, integrates the two earlier models. It primarily uses interactive exercises with students to integrate all of the meaning. Advocates of this interactive paradigm recognize the significance of prior information and forecast, while highlighting the significance of processing vocabulary in the text concurrently (Carrell, Devine, & Eskey, 1988; Dubin & Bycina, 1991; Grabe & Stoller, 2019).
- To further elaborate on this combination, Harmer (2001) claims that sometimes readers are helped by specific details, while other times they are helped by the broad idea of the text.
- To analyze textual details. As a result, the reader and the text both contribute significantly to making reading and comprehending easier (Carrell & Eisterhold, 1988).
- Reading Strategy in Reading Comprehension

3.3.1. Skimming

When readers skim text in an attempt to read it more rapidly, they are engaging in the skimming approach. According to Lee Kai and Paula (1979), the ability to skim and comprehend the relationship between concepts requires two things: first, motivation or interest in the subject matter; and second, the ability to discern where the main points are and where the supporting information end. Skimming is the process of rapidly determining a text's core concepts. When skimming, reading occurs three to four times more quickly than when reading normally. When faced with a large volume of material to read in a short period of time, people frequently skim.

According to (Konstant, 2003) there are three types of skimming:

- skimming to overview: identifying what a reading passage is basically about.
- Skimming to preview: re-reading a passage in order to gain as much information as possible.
- Skimming to review: refreshing and familiarizing the reader with the content.

3.3.2. Scanning

It entails closely reading the text to extract specific information that is hidden there. The necessary information is the main focus. Asking students to look for information, like a definition or the name of a person or location, and having them start at the same time to see who can discover it first is a helpful strategy to teach this skill (Beale, 2013).

A scanning strategy is skimming a text quickly in order to find specific information inside it. According to Ken Heland (in Wakkang, 2004), scanning is a quick search for precise information as opposed to a broad impression. The reader must disregard anything regarding the important item being searched for when scanning. This ability is helpful for reviewing, collecting data, accessing reference materials, and determining whether a text has information that merits more investigation.

Reading a text closely in order to extract specific information that is concealed inside is known as scanning. The necessary data is the main emphasis. Asking students to look for definitions or names of people or places at the same time and seeing who is the first to locate it is a helpful method of teaching this skill (Beale, 2013).

3 .Gaining the meaning of words through context:

It refers to making connections between the knowledge and comprehension of the symbolic language used in reading and other experiences or readings that the reader has completed. Kim (2008: 25) suggests four methods for determining a word's meaning based on its context:

- analyzing the word and its context to determine the section of speech.
- examining the words' immediate grammatical context.
- examining the terms' larger context, which is typically found in a clause or phrases speculating on the meaning and subsequently verifying the accuracy of the guess.

4 .Inference:

It is the process of creating something wholly original by combining our own meaning with the words written on a page. We employ this ability when the concept is not expressed clearly. Because of this, proficient readers develop the skills of a detective and utilize hints to make assumptions about the text and the author's intent (Cuesta College, 2003).

5 .Prediction:

Using context to guide one's guesses and understanding of what will happen next is known as prediction. With greater involvement made possible by this ability, pupils' interest, reading speed, comprehension, and enhances their comprehension of the subtitles, title, and content. By posing queries or providing certain keywords, the teacher can help the pupils become more adept at making predictions (Kjhatzi, 2009).

6 .Sequencing:

According to Teacher Vision (2019), an adept reader is able to determine the sequence of events, the relationships within the text, the style in which the writer presents a chapter, and the keywords he uses, such as first, then, next, later, and finally.

7 .Distinguishing facts from opinions:

This ability aids students in understanding the material, eliciting multiple points of view, and helping them establish their own opinions on the subjects they read about. As a result, students are able to distinguish between opinions and facts. The Pupils base their opinions on what they know and the facts that are at their disposal, including names, dates, times, and quantities of locations and events (Learning Express Editors, 2011).

8 .Abstracting:

the capacity to summarize a text by concentrating on its key ideas and elements, allowing the reader to obtain an overview of the content. By doing specific exercises, such breaking the material up into sections, you can enhance this capacity. and a collaborative group of students summarizes each section.

As stated by Bailey (2013), this could assist the students in recognizing, making connections between, and remembering the key concepts in the text so they can utilize it to develop their reading comprehension skills and apply it to their own experiences.

9 .Note-taking:

According to Miller (2004), taking notes allows one to summarize the key points of the text so that the reader doesn't have to recall or edit everything they read. Taking notes enables pupils to better arrange their concepts, release their mind from needing to remember everything, organize newly acquired knowledge, narrow their reading focus, pick the crucial information, and conserve time and energy. One effective way to teach students how to take notes is to submerge them in a temporal source, such an oral conversation in class. Reading comprehension will be greatly aided by the notes that are made while reading books.

10 .Cohesion and Coherence:

According to Parvaz and Nodoushan (2006), students can use several markers, such as pronoun reference, anaphoric and cataphoric features, or a logical tense, to produce coherence and cohesiveness. structure, specific articles, and implications and presumptions related to general knowledge of the world.

11 .Visualizing:

The activities, people, and places in the text allow the reader to visualize the material, which increases the reader's engagement with the reading experience. It is just one of several abilities that enable kids to comprehend the text they are reading completely by using the words to conjure up images in their minds. Students who visualize are able to read more deeply and retain what they have read for longer periods of time.

Types of spatial thinking

(S. Diwakar, When information is presented graphically, spatial relationships are shown visually. Different kinds of spatial interactions between features are conceivable. It takes up a lot of storage space to implicitly record geographical relationships. Processing data becomes slower when spatial relationships are computed instantly, especially when relationship information is needed regularly. Topological and proximal relationships are two categories of spatial relationships:

The topological relationship that you will be reading about describes the properties of adjacency, connectedness, and containment of contiguous features. The property of closeness of non-contiguous features is expressed by proximal relationships.

When processing and modeling geographical data, spatial linkages are crucial. The goal of organizing and structuring data is to handle geographical relationships while requiring the least amount of compute and storage.

Domains of spatial thinking

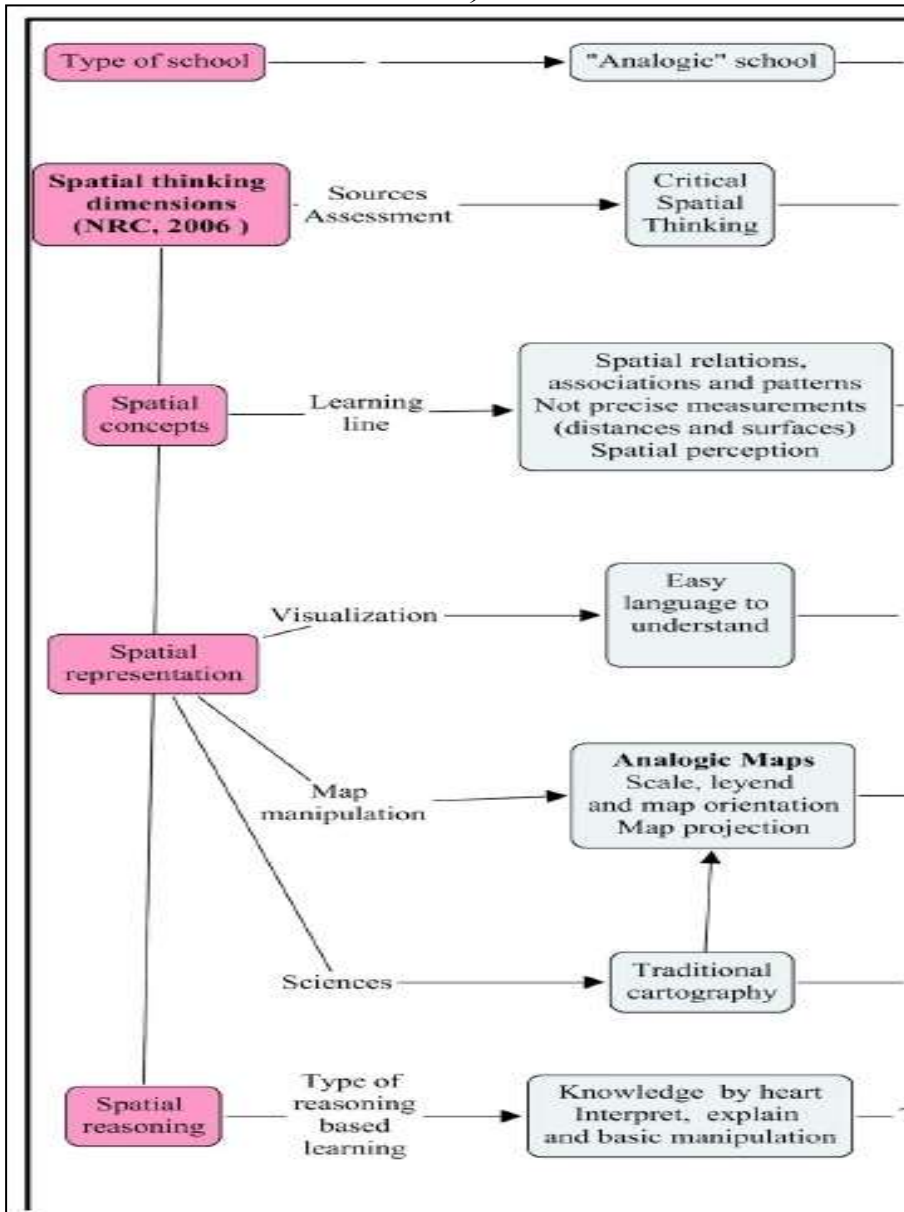
Schulze et al. (2013) examined the main aspects of spatial thinking in the context of the Spatial Citizenship initiative. Critical thinking, geography, GIS knowledge and skills, problem solving, spatial thinking, cooperation and collaboration, visualisation, and communication are the seven interconnected competences that they identified and explained.

Table 3: Domains connected with spatial thinking (after Schultz et al, 2013) JOHNSON

Competence areas	Description
Critical thinking	Use GI technology appropriately within an applied environment; critically and independently apply GIS; determine whether GIS applications are beneficial.
Geography	knowledge of geography and comprehension of the nature of relationships between places, including patterns, processes, and changes.
GIS knowledge and skills	Acquire, handle, manipulate, analyze, and model; convey and visualize geographic information and spatial data; comprehend and be knowledgeable about GIScience principles.
Problem-solving	Apply geographic knowledge and insight to solve real-world issues; cultivate problem-solving abilities in GIScience.
Spatial thinking	presenting complicated spatial information; performing complex spatial analysis and modeling; and grasping the fundamentals of spatial knowledge, analysis, and application.
Teamwork and collaboration	Engage in GIS use and participation in interdisciplinary teams and environments; collaborate with other experts; oversee and direct GIS projects.
Visualization and communication	Present and visualize (geo)spatial data; efficiently convey geographic data to various target audiences, including the general public, decision-makers, and scholars.

Dimensions of spatial thinking

To gain knowledge of the three aspects of spatial thinking—spatial conceptions, geographic representation, and spatial reasoning—as defined by the National Research Council (NRC, 2006).



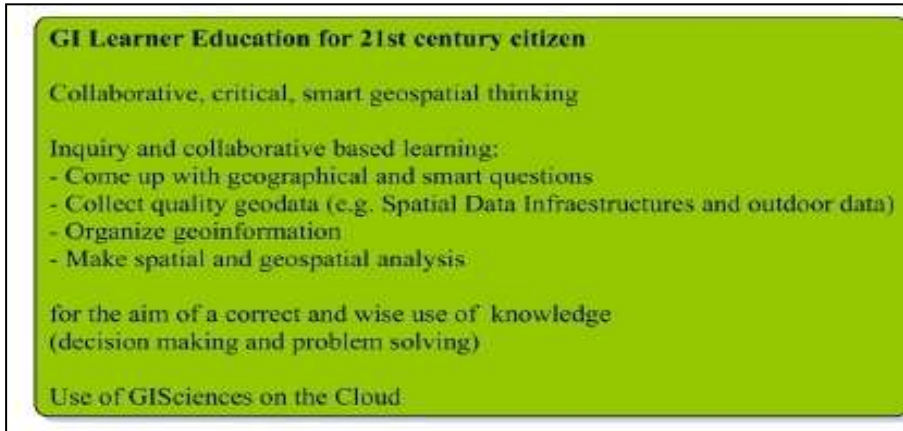
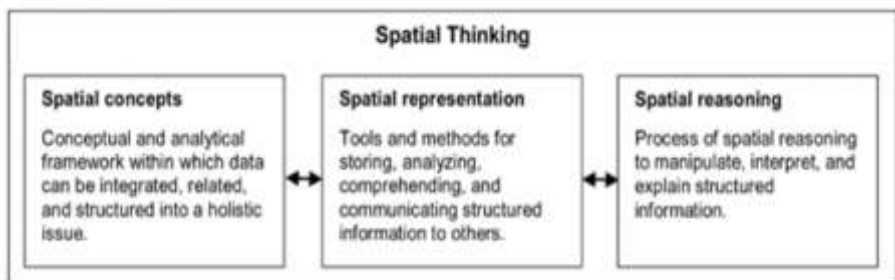


Fig. 2

According to LEE and BEDNARZ (2006), spatial thinking is a useful synthesis of three interrelated ideas: the nature of space, techniques for encoding spatial information, and the spatial reasoning procedures. As a method of thinking that transcends academic boundaries, spatial thinking is the spark that improves learning of subjects across the curriculum (BEDNARZ, 2005).

Figure 3: Spatial thinking dimensions and related terms according to NRC, 2006. Drawn by: Michel & Hof (2013)



Characteristics of DDL

There is a big difference data-driven language learning and traditional teaching mode. Its characteristics can be summarized in four aspects (Zhen, 2005).

First, DDL centers on learner autonomy. Data-driven learning emphasizes the students' autonomic learning, in which activities in the class are student-centered rather than led by the teacher to give full play to their personal characteristics. Learners are not passive recipients of the knowledge, but take on the active roles of discoverers and researchers, sorting through massive language data to discover rules and patterns embedded in the data, and can self-regulate learning strategies according to their own requirements. In other words, learner autonomy is cultivated by encouraging students to be responsible for their own learning.

Second, the primary linguistic input for DDL is derived from extensive, authentic corpora. Students can access large volumes of high-quality language data from actual communicative actions using corpus-based data-driven learning. To put it briefly, data-driven learning can help students learn authentic language by providing them with a real-world setting in which they can hone their linguistic intuition and experience handling linguistic diversity.

Third, DDL places a strong emphasis on the process of learning exploration and discovery. Instead of receiving direct instruction from the teacher, students learn through problem-solving exercises. In order to let students examine the learning process in accordance with their own desires to experience, investigate, and find linguistic knowledge, data-driven learning gives them access to a wealth of real data based on corpuses. Students will gain more authentic and systemic language knowledge as a result, and their impression will be stronger.

Lastly, DDL promotes inductive learning from the bottom up. Instead of prescriptive grammatical rules, students encounter a great deal of actual language data at the outset of data-driven learning. Following their own observations, kids will extrapolate grammar rules. When working on tasks like learning grammatical structures and lexical items, students can quickly acquire a list of contextualized instances of the researched feature with the use of concordance software.

Advantages of DDL

According to (Boulton, 2009), DDL appears to be most helpful for expanding or enhancing one's understanding of already-existing language elements, identifying closely related synonyms, seeing usage patterns, collocation, colligation, morphology, and other related topics. Learners may become more aware of concerns related to discourse and style, register and text type, frequency and typicality, and the ambiguity of language itself.

improving (or observing) one's level of awareness through the use of a concordancer to identify patterns and forms in order to increase input (Azzaro, 2012; Chang & Sun, 2009; Daskalovska, 2015; Scott & Tribble, 2006);

- enhanced lexico-grammatical item teaching and learning (Huang, 2014; Smart, 2014)
- correcting errors in reading and proofreading (Gaskell & Cobb, 2004; Chang, 2014; Chambers & O'Sullivan, 2004)
- cognitive and metacognitive growth (O'Sullivan, 2007; Yoon & Jo, 2014),

- rich exposure to actual language usage (Chen, 2011), and

learner centeredness (Biber, Conrad, & Reppen, 1998). More autonomy and lifelong learning have been linked to all of these advantages (Boulton, 2009b, 2011; Gilquin & Granger, 2010; Lin & Lee, 2015; Yoon, 2011).

DDL stages

For the DDL instruction, the following four-steps process (Chujo & Oghigian, 2008) was used:

- Step 1: Hypothesis formation through inductive DDL tasks with hands-on tasks
- Step 2: Explanations from the teacher to confirm or correct these hypotheses
- Step 3: Follow-up exercises (homework) and teacher feedback on homework.
- Step 4: Production through follow-up exercises (in class) and teacher feedback on homework

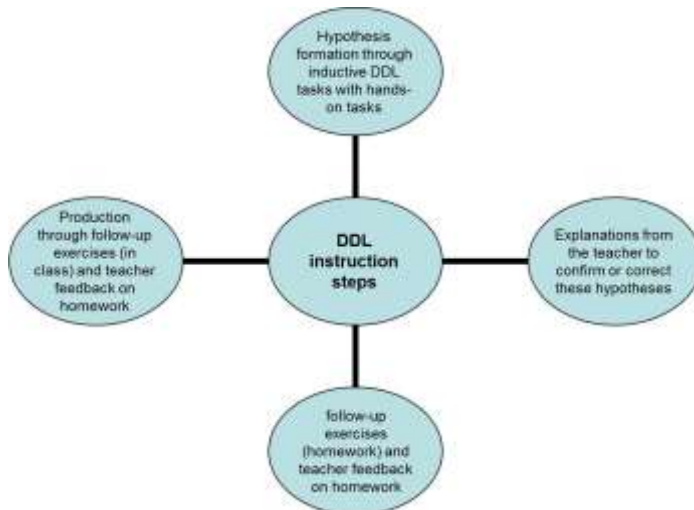
According to Flowerdew (2015) there are four-stages of applying DDL, such as: 1) Hypothesis formation through inductive corpus-based exercises, 2) explicit explanations from the teacher to confirm or correct these hypotheses, 3) hypothesis testing through follow-up exercises and 4) learner production. The first step is hypothesis formation. It can be done through inductive corpus-based exercises, in the classroom process students will be given corpus exercises by the teacher to stimulate students to learn the material that will be given.

The second step is explicit explanations from the teacher to confirm or correct these hypotheses, in the classroom the teacher will explain to confirm the corpus and student results.

The third step is hypothesis testing through follow-up exercises, in the classroom students will be given more in-depth exercise on the material being taught, the exercises have been designed by the teacher to help students during the learning process.

The last step is learner production, students will be given assignments based on the results of the material that has been taught during the process in class.

Fig. 4 DDL instruction steps, original



Developing EFL geography reading skills and their spatial thinking through using DDL

DDL and EFL reading comprehension

Many researchers recommend the necessity of treating written texts and the skills of reading them in a way that

depends on understanding and imagining them so that they are easy to understand, even if these texts are related to real phenomena. This is because understanding and understanding them facilitates access to the true meaning and interprets it, and this goal can be achieved by involving students in experiencing reality through the steps of the program DDL and its activities (Gaëtanelle, G, Sylviane, G, 2010)

These activities included in the DDL program, which are characterized by depth and diversity, contribute to developing reading comprehension skills as they relate to the advanced linguistic level of learners and training them to use many synonyms and complete sentences that the program can develop through different and varied methods, as an example (so-called KWIC – Key-Word-In-Context – view). (Breyer, 2006)

2.DDL and geography teaching

The nature of the science of geography and dealing with a huge amount of diverse data is subject to rapid growth in light of the era of the cognitive revolution and with the use of many modern devices and applications in collecting geographic information and statistics, which makes processing this data with programs such as the DDL program necessary.(Dumbill, 2012)

One of the characteristics of the DDL program is the reliance on the use of many activities based on realism and related to practical life, which makes it closer in dealing with the science of geography, which is easy to process and adding activities that make learning more effective and linked to the student's practical situations. (Cheong, 2013; Campoy-Cubillo et al., 2010).

Inductive learning and discovery are among the modern trends in learning geography, which encourages learners to obtain knowledge on their own in response to the recommendations of modern educational research and studies, which is something that the steps of the DDL program contribute to achieving. (Miller, 2015)

Perhaps the most transformative impact of datadriven science on geographic knowledge-discovery will be through data-exploration and hypothesis generation (Miller, 2010).

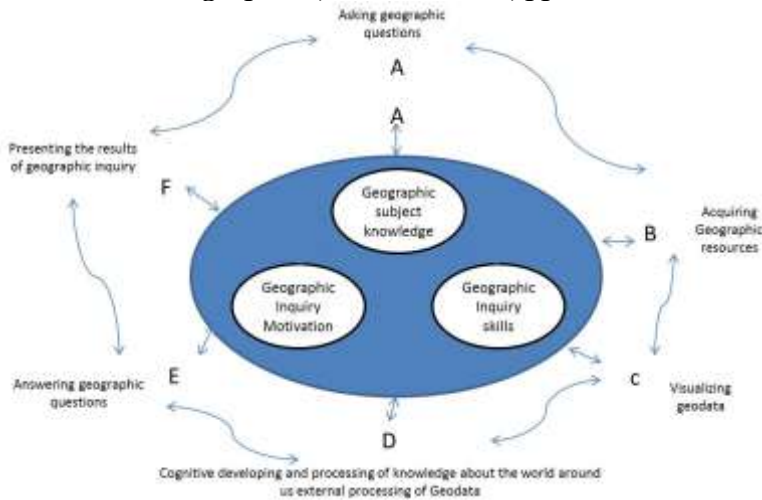
Abductive reasoning requires four capabilities:

the ability to posit new fragments of theory; (2) a massive set of knowledge to draw from, ranging from common sense to domain expertise; (3) a means of searching through this knowledge collection for connections between data patterns and possible explanations, and; (4) complex problem-solving strategies such as analogy, approximation, and guesses. Humans have proven to be more successful than machines in performing these complex tasks, suggesting that datadriven knowledge-discovery should try to leverage these human capabilities through methods such as geovisualization rather than try to automate the discovery process. Gahegan (2009) envisions a human-centered process where geovisualization serves as the central framework for creating chains of inference among abductive, inductive, and deductive approaches in science, allowing more interactions and synergy among these approaches to geographic knowledge building.

3. DDL and spatial thinking

Reginald G. (2002) has stated that knowledge is the product of spatial thinking and mental processes that develop many abilities such as comparison, understanding and interpretation. What geography suffers most from is the lack of defining spatial concepts and skills necessary for production and communication which can be overcome through the DDL program, as it relies on in-depth steps and activities that contribute to

Figure 5: Reginald G. Golledge (2002) : The Nature of Geographic Knowledge Annuals of Association of American Geographers, Vol .92 No. 1, pp 1-14



Geographic language competence

What does communication and language mean in geography classes? The model (Figure) provides an overview and visualization of language registers and concepts of language competences relevant in schools and beyond, and which are considered in consistent language education. The model illustrates how these registers

connect to language in geography classrooms. This overview of registers is necessary since language in geography is not an entirely new language register or competence, but rather arises out of given registers with certain geographic specifics explained subsequently.

Structure of the model

The model resembles a cube's profile. The portions of layers inside them are contained by the outer layers. The theoretical extent of the registers in school usage is represented by the area of space that the layers assume. Every layer is positioned on the fundamental ground layer, which is represented by tiny dots (the Geographic Content Layer). This implies that the action of geographic context is where all linguistic requirements in geography occur, as well as how they relate to features of other registers.

The four columns of receptive, interactive, productive, and mediation and transfer abilities are another important component of the model, in addition to the register layer (CEFR, 2011). These elements, which will be elaborated upon later, organize the language requirements according to their executive performance in the classroom.

The model intends to structure language requirements in geography classes. It allows identification of communication skills pupils need to satisfy language requirements. This structure will enable planning and use of suitable teaching strategies, for example the integration of scaffolding processes (Gibbons, 2002). The explanation starts with the utmost layer (F) and ends with the concept

of geographic language competence in the core of the model.

The concept of language in geography refers to the particular geographic needs that language in geography education must meet. Few empirical studies have previously examined the particular communicative needs in geography classes (Budke & Weiss, 2014, p.14;q Müller & Falk, 2014; Michalak & Müller, 2015). According to Budke and Weiss (2014), language-awareness in geography instruction is based on the learning circumstances of the students and takes into account the language requirements needed for comprehension of and responses to geographic concerns in lessons (Budke & Weiss, 2014, p. 15). Here are the two approaches taken to language in geography classes.

The first one is organizing geographic language at the word, phrase, and textual level. Effective placement of scenarios that aid in the teaching and learning of geographic language is possible within this framework. The collection and application of geographic key phrases are included in E1. This structure is related to the requirements and occurrences in the content, such as the glossary or important terms. includes sentence structure and content that can be coupled to and supplemented by other materials, including model texts or helpful phrases used in scaffolding processes. focuses on teaching written texts as a whole, covering their coherence and qualities in the geography classroom (e.g., normative argumentation in spatial conflicts or map appraisal).

The second one, which will be further discussed in the following, relates to geographic discourse processes, or how geographic language is created in geography classrooms. It is necessary to clarify that language use in geography can be conceptually written or conceptually spoken, whether it is done by the teacher or the student. These performances should be viewed as a continuum, for instance, one side showing a discussion among students participating in cooperative group work, and the other side showing how students perceive an item from a school book. Additionally, students' medial perception of language is significant and can be further classified into two categories: phonetically, through sounds, or graphically, through letters in a text or symbols and colors, like in maps. To put things in context, visual and textual information are frequently mediated in geography instruction. In order to address the main topic of the class, students are frequently expected to select information from a variety of sources, including maps, images, diagrams, charts, movies, and texts. Students must be able to decode and generate various linguistic codes from various channels of perception in order to complete this technique. The model shows how distinct performance and perception modes exist in geography. In response, lesson preparation and reflection must be adjusted to accommodate students' linguistic needs as they work with the codes and channels.

Method

Participants of the study

The participants of the study included thirty students enrolled in first year Geography college of Education,

Shebin El-Kom, Menofia University in the academic year 2022-2023.

Instruments and materials of the study

- A pre-posttest to measure EFL reading comprehension among geography college of education freshmen
- A program based on DDL
- An EFL reading checklist
- Spatial thinking checklist
- Reading comprehension test

Aim of the test

The aim of the test (appendix A) was to measure EFL reading comprehension and spatial thinking skills before and after applying the program among geography college of education freshmen using DDL.

Description of the test

The reading test was divided into two sections: the first section was related to reading sub-skills (literal – inferential – creative) and the other was related to spatial thinking sub-skills (interpreting information – asking questions related to the place – determining spatial preference – changing over time).

Test validity

The test was submitted to a panel of jurors who are specialists in TEFL to validate it in terms of clarity and suitability. The juror's comments were very useful and effective for the study.

Test reliability

To establish the reliability of the test: the test and retest reliability was used. The test was administered to 15

students. After two weeks, the test was administered again to the same students. Students' scores on both tests were correlated.

The program

Aim and objectives

The program aims at developing EFL reading comprehension skills and spatial thinking among geography college of education freshmen through using DDL based program. By the end of the programs, students will be able to:

Objectives:

- To utilize Data-Driven Learning (DDL) techniques to improve EFL reading comprehension skills among Geography College of Education freshmen.
- To develop spatial thinking abilities through the application of DDL in geography education.

Materials:

- Geography texts with embedded spatial information.
- Computers or tablets with internet access.
- Data visualization tools (e.g., Google Maps, GIS software.)
- Worksheets or activities for reading comprehension and spatial thinking.

Session Overview:

- Introduction to Data-Driven Learning and Its Benefits (15 minutes)
- Hypothesis Formation and Exploration (20 minutes)
- Explicit Explanations and Feedback (15 minutes)

- Hypothesis Testing and Analysis (30 minutes)
- Application and Extension (20 minutes)
- Reflection and Wrap-Up (15 minutes)

Detailed Session Plan:

- Introduction to Data-Driven Learning and Its Benefits (15 minutes)
- Objective: To understand the concept of Data-Driven Learning (DDL) and its potential benefits in language learning and geography education.
- Welcome the students and introduce the objectives of the session.
- Discuss the significance of DDL in improving EFL reading comprehension skills and fostering spatial thinking abilities.
- Explain how DDL utilizes real-world data to enhance learning experiences and facilitate deeper understanding.
-
- Hypothesis Formation and Exploration (20 minutes)
- Objective: To develop hypotheses about spatial relationships in geography texts and explore spatial concepts.
- Present a geography text with embedded spatial information to the students.
- Instruct students to analyze the text and form hypotheses about the spatial relationships presented.
- Encourage students to explore spatial concepts and patterns within the text independently or in pairs.
- Explicit Explanations and Feedback (15 minutes)
- Objective: To provide feedback on hypotheses and reinforce key spatial thinking concepts.

- Provide explicit explanations to confirm or correct the hypotheses formed by students.
- Discuss the hypotheses generated by students and provide feedback on their accuracy.
- Clarify any misconceptions and reinforce key concepts related to EFL reading comprehension and spatial thinking.
- Hypothesis Testing and Analysis (30 minutes)
- Objective: To test hypotheses and analyze spatial information in geography texts.
- Engage students in follow-up activities designed to test their hypotheses and further explore spatial concepts.
- Provide additional geography texts or spatial data sets for analysis.
- Instruct students to apply their hypotheses and spatial thinking skills to interpret the new materials.
- Facilitate group discussions to analyze the spatial information and draw conclusions based on their findings.
- Application and Extension (20 minutes)
- Objective: To apply spatial thinking skills in real-world scenarios.
- Assign tasks or projects that require students to apply their learning to real-world contexts.
- Examples of assignments may include creating maps, conducting spatial analysis, or writing essays on geographic topics.
- Provide opportunities for students to apply their EFL reading comprehension and spatial thinking skills in creative and meaningful ways.
- Reflection and Wrap-Up (15 minutes)

- Objective: To reflect on learning experiences and reinforce key concepts.
- Conclude the session with a reflective discussion where students share their experiences and insights gained from the activities.
- Encourage students to reflect on how DDL has helped them improve their EFL reading comprehension skills and develop spatial thinking abilities.
- Summarize key learnings from the session and reinforce the importance of continued practice and exploration in language learning and geography education.

Discussion and Interpretation

Hypothesis One

1) There is a statistically significant difference at the level of (0.05) between the mean scores of the experimental group in the pre-posttest of EFL reading comprehension skills (literal comprehension – inferential comprehension – creative comprehension) in favor of the posttest ".

To test this hypothesis, the data obtained from the pre posttest of the reading comprehension test were treated statistically using the descriptive (Means and Standard Deviations) and (Paired Samples Test : t-test) statistics. table (4) shows this

Table (4) shows that the value of reading comprehension mean score of the post test was (12.03) which is higher than that of the pretest which was (4.70). As table (4) shows the posttest's scores were higher than those of the pretest in Reading comprehension test It also indicated a higher homogeneity (=Std. Deviation / Mean) of the

posttest's grades than the grades of the pretest due to the application of using a DDL Based Program.

Table (4) Results of Pre-test and Post-test in Reading comprehension of the Experimental Group (n = 30)

Skill	Application	N.of cases	Means	Std. Deviation	Paired Differences		t.Value	Df	Sig.
					Mean	S.D			
Literal comprehension	Post- test	30	3.93	0.83	2.13	1.25	9.33	29	0.001
	Pre- test	30	1.80	0.92					
Inferential comprehension	Post- test	30	3.60	0.56	2.33	0.80	15.93	29	0.001
	Pre- test	30	1.27	0.64					
Creative comprehension	Post- test	30	4.50	0.73	2.87	1.14	13.81	29	0.001
	Pre- test	30	1.63	0.85					
All Reading comprehension	Post- test	30	12.03	1.77	7.33	2.19	18.37	29	0.001
	Pre- test	30	4.70	1.21					

Table (4) reveals that there is a significant difference between the overall mean scores of the pre- posttest administrations of Reading comprehension test in favor of the post test. t- value was (18.37) which is significant at the (0.01) level in favor of the posttest.

This is represented graphically in figure (4)

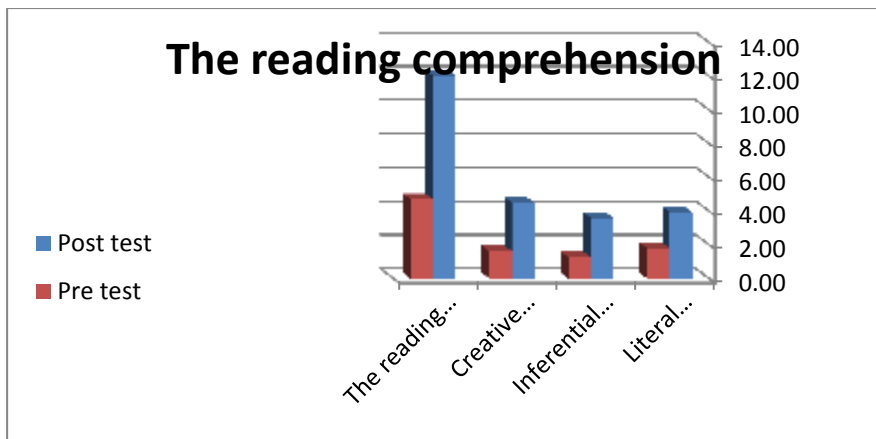


Figure (4) Bar Chart of the Mean Scores of the pre- posttest.

Determining the Effect Size:

To investigate the effect and educational importance of the results, the value of ETA squared (η^2) and the effect size (d) were calculated. " using the following equation.

$$\eta^2 = \frac{f^2}{T^2 + d.f}$$

Table (5) Reference standers of (η^2) and (D) values.

Test	Effect volume		
	Small	Medium	Large
η^2	0.01	0.06	0.14
D	0.2	0.5	0.8

Table 2

Values of (η^2) and the Effect Size of the Treatment on Improving the

Reading comprehension of the Experimental Group

Skill	t-value	d.f	Sig	η^2	d	Effect size
Literal comprehension	9.332	29	Significant at (0.01)	0.75	1.73	Large
Inferential comprehension	15.93	29	Significant at (0.01)	0.90	2.96	Large
Creative comprehension	13.814	29	Significant at (0.01)	0.87	2.57	Large
All Reading comprehension	18.369	29	Significant at (0.01)	0.92	3.41	Large

ETA squared was 0.92 reflecting its practical significance. And in the light of this, It can be said that 92% of the variations between the scores of Students in the Reading comprehension could be due to a DDL Based Program, and the effect size (d) = 3.41 and that there was height effect and educational importance for improving and developing Reading comprehension.

Hypothesis Two:

"There is a statistically significant difference at the level of (0.05) between the mean scores of the experimental group in the pre-posttest of spatial thinking skills (interpreting information skill – asking questions related to the place – determining spatial preference – changing overtime) in favor of the posttest."

To test this hypothesis, the data obtained from the pre posttest of the spatial thinking test were treated statistically using the descriptive (Means and Standard Deviations) and (Paired Samples Test : t-test) statistics. table (6) shows this

Table (6)

Results of Pre-test and Post-test in Spatial thinking of the Experimental Group (n = 30)

Skill	Application	N.of cases	Means	Std. Deviation	Paired Differences		t.Value	Df	Sig.
					Mean	S.D			
Interpreting information skill	Post- test	30	2.67	0.48	1.80	0.55	17.90	29	0.001
	Pre-test	30	0.87	0.63					
Asking questions skill related to the place	Post- test	30	2.73	0.45	1.70	0.79	11.72	29	0.001
	Pre-test	30	1.03	0.67					
Determining spatial preference	Post- test	30	2.80	0.41	1.97	0.81	13.32	29	0.001
	Pre-test	30	0.83	0.65					
Changing over time	Post- test	30	1.80	0.41	1.37	0.67	11.20	29	0.001
	Pre-test	30	0.43	0.50					
All Spatial thinking	Post- test	30	10.00	1.44	6.83	1.29	29.04	29	0.001
	Pre-test	30	3.17	0.95					

Table (6) shows that the value of spatial thinking mean score of the post test was (10) which is higher than that of the pretest which was (3.17). As table (6) shows the

posttest's scores were higher than those of the pretest in Spatial thinking test It also indicated a higher homogeneity (=Std. Deviation / Mean) of the posttest's grades than the grades of the pretest due to the application of using a DDL Based Program.

Table (6) reveals that there is a significant difference between the overall mean scores of the pre- posttest administrations of Spatial thinking test in favor of the post test. t- value was (29.04) which is significant at the (0.01) level in favor of the posttest.

This is represented graphically in figure (6)

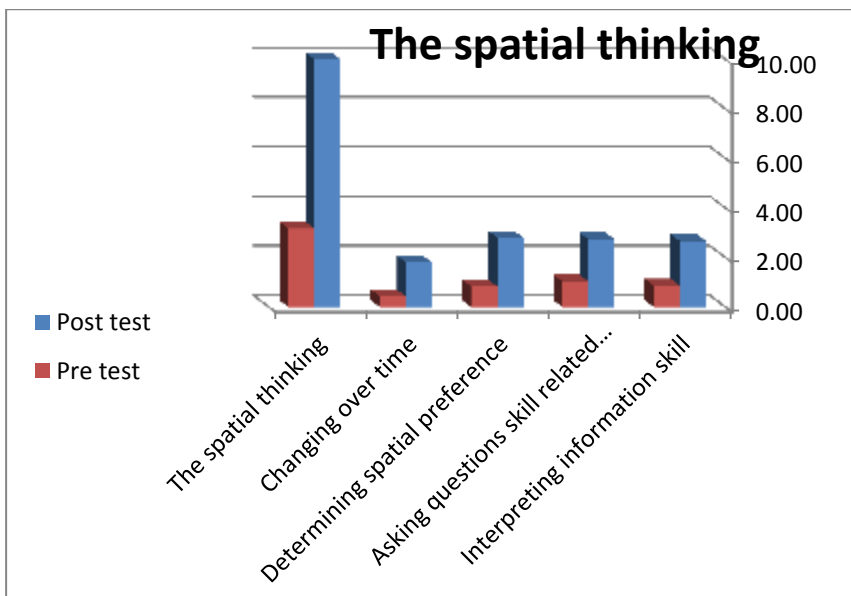


Figure (6) Bar Chart of the Mean Scores of the pre- posttest.

Determining the Effect Size:

To investigate the effect and educational importance of the results, the value of ETA squared (η^2) and the effect size (d) were calculated.

Table (7) Values of (η^2) and the Effect Size of the Treatment on Improving the Spatial thinking of the Experimental Group

Skill	t-value	d.f	Sig	η^2	d	Effect size
Interpreting information skill	17.897	29	Significant at (0.01)	0.92	3.32	Large
Asking questions skill related to the place	11.721	29	Significant at (0.01)	0.83	2.18	Large
Determining spatial preference	13.32	29	Significant at (0.01)	0.86	2.47	Large
Changing over time	11.195	29	Significant at (0.01)	0.81	2.08	Large
All Spatial thinking	29.041	29	Significant at (0.01)	0.97	5.39	Large

ETA squared was 0.97 reflecting its practical significance. And in the light of this, It can be said that 97% of the variations between the scores of Students in the Spatial thinking could be due to a DDL Based Program, and the effect size (d) = 5.39 and that there was height effect and educational importance for improving and developing Spatial thinking .

Hypothesis Three

There is a positive correlation relationship between students’ scores in the reading comprehension and the spatial thinking skills.

To verify this hypothesis, data were treated statistically, To show the significance of the correlation between students’ scores in the reading comprehension and the spatial thinking tests, Pearson Correlation was calculated. This is illustrated in table (8):

Table (8) Pearson Correlation between students’ scores in the reading comprehension and the spatial thinking

		Interpreting information	Asking questions skill related to the place	Determining spatial preference	Changing over time	All Spatial thinking
Literal comprehension	R	0.477**	0.461**	0.472**	0.466**	0.484**
	R2	0.23	0.21	0.22	0.22	0.23
Inferential comprehension	R	0.465**	0.517**	0.481**	0.491**	0.476**
	R2	0.22	0.27	0.23	0.24	0.23
Creative comprehension	R	0.492**	0.524**	0.580**	0.464**	0.623**
	R2	0.24	0.27	0.34	0.22	0.39
All Reading comprehension	R	0.460**	0.531**	0.536**	0.470**	0.596**
	R2	0.21	0.28	0.29	0.22	0.36

***.* Correlation is significant at the 0.01 level

Table (8) shows that the value of Pearson Correlation between students’ scores in the reading comprehension and the spatial thinking was (0.596) which is significant at the 0.01 level.

Results might be due to the following reasons:

Geography freshmen students were very excited because of linking studying EFL reading comprehension and spatial thinking with geography which enabled them to recognize new idioms, new concepts and creative ideas for the reading passage following DDL stages.

The students’ progress in the results of the post-test for reading comprehension and spatial thinking after conducting the experimental treatment is due to the fact that integrating the skill of reading in English with the study of geography contributes to enhancing the students’ understanding of new concepts, and improving their ability to communicate and interact with information more deeply.

Reading comprehension skills require advanced strategies for acquiring knowledge and dealing with specialized text materials in the field of geography. Therefore, using the DDL program has proven effective in enhancing students' knowledge of the content and has contributed to stimulating interest in reading and improving their performance. Especially when he linked ancient knowledge with the students' previous knowledge, which attracted greater interest from students and deeper involvement in the learning process.

Hence, integrating geography with reading and writing skills achieved an important goal, which is to enhance deep understanding of the text, and thus it became easier to develop spatial thinking skills linked to a conscious cognitive background. This was demonstrated by the results of the control group that was taught in the usual way, so there became clear differences, whether on the level of achievement or Reading comprehension and spatial thinking.

The positive results of the experiment may also be due to the use of geographical texts appropriate for students in terms of the variety in presenting them in more than one image, either presented in text or through drawings, maps, or shapes, which added to the students' motivation to learn and enthusiasm for deeper knowledge and more.

The students' results in the spatial thinking skills test were positive, and this may be due to the fact that using the spatial dimension to transform data into information helps us understand geographical phenomena. It is clear here that

using DDL to provide students with effective communication activities can create an appropriate environment to improve their language skills and help them acquire an authentic language.

Also, the four steps of the DDL based program, each step may have contributed to achieving the research objectives effectively, as their arrangement, starting with induction tasks and assigning students practical tasks, contributes to the formation of knowledge in a more comprehensive way, and then comes the step of returning to the teacher in order to correct what was done. Emphasizing the correct ones, and the previous two steps are followed by a step that supports this by giving the students home tasks in which they verify visual comprehension and spatial thinking skills. This is followed by the last step of the teacher commenting on everything that the students said, which leads to feedback that corrects any error and confirms and encourages the students to perform correctly.

It has also been found in studies that one of the advantages of the DDL program is that it is possible to develop a number of learning skills, such as prediction, observation, analysis, interpretation, contemplation, exploration, and comparison, which was also evident from the results of the research, as the impact of language exploration moved to a deeper understanding. Thinking at multiple levels, including spatial thinking. Perhaps the results of the research support the principles of learner independence that the DDL program focuses on through

many activities that revolve around the student, using a rich set of real communication activities that can create an authentic linguistic environment for students to improve their linguistic intuition and their ability to deal with language differences.

These activities also support exploration rather than receiving direct instructions from the teacher according to their own needs. As a result, the language knowledge students acquire will be more authentic and systematic, and the impression will be deeper.

The research results are consistent with the change in the geographical research context from being based on a data-scarce environment to a data-rich environment, where the main changes were not only limited to the volume of data, but also to its diversity and speed of its flow, and these developments are often linked to the concept of big data. . Data-driven geography is emerging in response to the increasing amount of large, unstructured geographic data.

Learning comes through the steps of the program, using words with sentences, and organizing texts. This becomes supportive of learning the geographical language effectively, which is what happened through the use of geographical terminology and understanding the content of geographical texts such as maps and articles, and students can express their ideas orally or in writing. They can learn language alongside visual data such as maps and pictures and this is demonstrated by their ability to understand and produce geographical language in different forms.

Conclusion

- DDL based program has proven its effectiveness on developing EFL geographical reading skills as a whole and each skill separately through using explorative and motivated activities which led to developing the inductive learning process. These result are in line with many of the results of previous studies such as (Elmanshi, 2021, Boontam, 2022, Guan, 2013) that proved the effectiveness of the program in developing vocabulary, grammar and discourse.
- It has proven as well that there was an effectiveness on the spatial thinking as a whole and each skill separately through using spatial activities relted to the real life situations which helps in developing many skills starts from the induction to interpreting geographical information included in geographical texts.
- In addition, there was a coeffeciet correlation relationship between reading skills and spatial thinking as a result of depending spatial thinking on EFL reading skills which cannot be separated form each other.

Recommendations

- Based on the results of the current study, the following recommendations are offered
- Developing EFL reading and spatial thinking skills through using DDL based program in different educational stages.
- Implementing EFL reading and spatial thinking skills in geographical preservice teachers program.
- Preparing courses for EFL geographical inservice teachers for further new curriculum development in EFL reading and spatial thinking skills.

Suggested researches

- Using DDL in enhancing concepts for different stages.
- Using DDL in enhancing creative thinking skills for different stages.
- Using DDL in treating learning disabilities for different stages.

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