The Roles of Schemata in Reading Comprehension: An Empirical Study among Ielts Test Takers at a University in Hanoi

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ABSTRACT: The present study employed a mix-method research design to identify the impacts of activation of schemata on the reading comprehension scores and the individual differences and text characteristics influence (if any) the relationship. The study was conducted with 68 students of different learning styles; Visual learner, n=12; Auditory learners, n= 23; Group learners, n=19 and Individual learners, n=14. The findings reveals that students who were introduce schemata (experimental group) activation gained better reading scores, M=6.89 while the control group gained the score which was much lower, M= 4.65. The statistical analysis ANOVA was used to identify the difference in the means scores of participants with different learning styles. The ANOVA was examined based on an alpha value of .05. The results of the ANOVA were significant, $F(3, 64) = 4.55$, $p = .006$, indicating there were significant differences in Experimental group among the levels of Learning style. In the first place was Auditory leaners M= 7.19. Ranking in the second place was Auditory learners with M=7.19, following by Group leaners and Visual learners with M= 6.73 and 6.42 respectively.

KEYWORDS: Schemata activation, reading comprehension, learning styles.

I.   INTRODUCTION

1.1.   Rationales

Reading comprehension is a complex cognitive process that involves the interaction between readers and text. Schema theory suggests that prior knowledge and experiences, represented in schemata, play a crucial role in how readers make sense of text. Schemata, or cognitive frameworks, are essential for understanding and making sense of written texts. They encompass our pre-existing knowledge, experiences, and mental structures that help us interpret and process new information. It is important to note that schemata play a crucial role in activating a reader's prior knowledge related to the topic or content of a text. When readers connect new information to their existing knowledge, it enhances their understanding of the text (Anderson & Pearson, 1984). It provides the context needed to understand unfamiliar words, phrases, or concepts in a text. They help readers make sense of the text by filling in gaps and clarifying ambiguous information (Carrell, 1983). On the other hand, schemata enable readers to make predictions and inferences about the text. By drawing on their background knowledge, readers can anticipate the content, outcomes, and possible developments in the text (Rumelhart, 1980). They contribute to text coherence and cohesion. They help readers recognize how different parts of the text relate to each other and maintain a coherent understanding of the content (Kintsch, 1988). When readers encounter difficulties or inconsistencies in a text, their schemata come into play by helping them identify and resolve problems. Readers actively adapt and adjust their schemata as needed to address comprehension challenge (Gernsbacher, 1985)

1.2.   A statement of problem

Reading comprehension is a fundamental skill in education, and it is influenced by the interaction between a reader's prior knowledge, or schemata, and the text being read. While research has established the importance of schemata in comprehension, there is a need for a comprehensive understanding of how schemata impact the cognitive processes of readers and how this interaction is influenced by individual differences and text characteristics. This study seeks to investigate the roles of schemata in reading comprehension and to explore the implications for effective reading instruction, assessment, and addressing diverse learner needs.

The requirement of foreign language proficiency has become one of the prerequisite for graduation in many institutions around the world. In Vietnam, most university students are required to obtain B1 (CEFR) in English in order to receive the university qualification. The most widely accepted English test result is the IELTS ranging from 4.5 to 5.5 overall bands. For most IELTS test-takers, the reading module is the hardest part of the test. The difficulties experienced by these language learners might be explained as lack of reading strategies or poor background knowledge of the given topics or of the world in general. Many of the IELTS

candidates reported that they had never heard of the arguments discussed in the reading passages before. Furthermore, reading comprehension has been one of the challenging tasks for IELTS test-takers. The time constrains and topic diversities have been the causes of low achievement in the reading module. Many of the reading passages deal with unfamiliar topics to readers. In other words, there is no connection between new information with the existing information. We experience the world through reading and listening. All these experiences are then stored in the schemas. According to McGee and Richgels, a schema is a "mental structure in which we store all the information we know about people, places, objects, or activities" (1996, 5). If we have no schema for a particular topic, we begin that encounter with an immediate loss of comprehension. Schemata can be loosely defined as patterns which represent the way experience and knowledge are organized in the mind. The schema for concept like 'break', for instance, will have associated with it at least the following 'variables', or 'slots', (i.e., sub-components of the schema): 'the breaker', 'the thing broken', 'the method or instrument' for the action of breaking, and the notion of 'causing something to change into a different state'. This study aims at investigating the importance of the roles of schemata in reading comprehension can inform reading instruction. By gaining insights into how schemata affect comprehension, educators can develop more effective strategies to scaffold and support readers, especially struggling or diverse learners.

1.3. Research questions

The research question for the study was to shed light on the impacts of activation of schemata on the reading comprehension scores and the individual differences and text characteristics influence (if any) the relationship. The research question could be formulates as followed:

What is the impact of the activation of schemata on reading comprehension, and how do individual differences such as students with different learning styles influence this relationship?

II. LITERATURE REVIEW

2.1. Schema Activation

Schema activation, in the context of reading comprehension, refers to the process by which readers bring their prior knowledge and experiences to the forefront of their minds and apply this knowledge to understand and make sense of the text they are reading. The concept of schema activation is a fundamental aspect of schema theory, which has been influential in the field of cognitive psychology and education. When individuals read a text, they draw upon their existing schemata (plural of schema) or mental frameworks, which are built from their prior experiences, knowledge, and cultural background. These schemata help them interpret the text and connect new information to what they already know. The process of schema activation involves the following steps: aaccessing relevant schemata: readers identify and access the schemata that are relevant to the topic, content, or context of the text. For example, if reading a text about a trip to the beach, readers may activate their "beach vacation" schema (Rumelhart, 1980). Once relevant schemata are accessed, readers bring them to the forefront of their thinking. This may involve consciously or subconsciously recalling memories, concepts, or experiences related to the topic. Readers use their activated schemata to make predictions, interpret text, and fill in gaps in the information presented. For instance, when reading about a beach vacation, they may anticipate details about the beach, sun, sand, and activities based on their prior knowledge. As readers progress through the text, they may adapt or adjust their schemata based on the new information they encounter. If the text introduces unexpected details, readers may modify their schema to accommodate this information. Schema activation is significant for several reasons, and it plays a crucial role in reading comprehension. Activating relevant schemata helps readers comprehend and make sense of the text. It allows them to connect new information to their existing knowledge, which aids in understanding. Schemata enable readers to predict what might come next in the text. This predictive processing helps in anticipating content and preparing for upcoming information (Anderson & Pearson, 1984). When there are gaps or implicit information in the text, schemata help readers fill in these gaps and make inferences, leading to a more complete understanding. Schema activation takes into account individual differences and cultural backgrounds, allowing readers to bring their unique perspectives to the reading process. Information that is connected to existing schemata is often better remembered and recalled, as it is integrated into one's cognitive framework (Carrell, 1983).

2.2. Schemata and Textual Integration

Schemata and textual integration are key concepts in the field of reading comprehension. Schemata, also known as schemas, refer to a reader's prior knowledge, experiences, and mental frameworks, while textual integration is the process of incorporating new information from the text into existing schemata. Schemata are mental structures that represent an individual's knowledge and experiences related to various topics or concepts. These schemata are developed over time and play a significant role in the comprehension of written text. Schemata include not only factual information but also the reader's expectations, beliefs, and cultural knowledge. When readers encounter text, they activate relevant schemata and use them to interpret, make predictions, and connect with the information presented. Textual integration refers to the process of assimilating new information from a text into existing schemata. As readers progress through a text, they integrate the new information into their pre-existing mental structures, modifying and expanding their schemata as needed. This integration process is critical for understanding the text, as it allows readers to connect

the dots and create a coherent mental representation of the content. The relationship between schemata and textual integration is bidirectional and dynamic. Readers activate relevant schemata when they begin reading a text. For example, if the text is about a visit to a zoo, readers may activate their "zoo visit" schema. As readers engage with the text, they encounter new information about the zoo visit. They integrate this information into their existing schema, adding details about animals, exhibits, and their experiences (Kintsch, 1988). Textual integration can lead to the modification or adjustment of schemata. If the text introduces unexpected details or challenges readers' existing knowledge, they may adapt their schemata to accommodate this new information. The successful integration of textual information into existing schemata leads to a coherent mental representation of the text, facilitating comprehension. Integrated schemata also assist readers in making predictions and inferences about what might come next in the text, which aids in comprehension (Carrell, 1983). The interplay between schemata and textual integration is a fundamental aspect of reading comprehension. Research in this area has shown that readers with strong schema activation and integration skills tend to comprehend text more effectively and are better at making inferences.

The understanding of how schemata and textual integration work together is essential for educators and researchers in the field of reading comprehension. It highlights the dynamic and interactive nature of comprehension and the role of prior knowledge in the construction of meaning from written text.

2.3. Schemata's Influence on Comprehension Strategies

Schemata's influence on comprehension strategies is a fundamental aspect of reading comprehension. Readers draw on their prior knowledge and experiences, represented in schemata, to apply various comprehension strategies when engaging with a text. Schemata play a pivotal role in shaping the comprehension strategies readers use to make sense of a text. Comprehension strategies are cognitive processes or techniques that readers employ to understand, remember, and analyze what they read. Schemata influence these strategies in the following ways: (1) Prediction: readers activate their schemata to predict what might happen next in the text. These predictions are based on their prior knowledge and experiences. For example, if readers have a schema for detective novels, they may predict plot twists or suspect motivations based on this schema. Pressley (2000) discusses the importance of cognitive strategy instruction, which includes the use of schemata and comprehension strategies to improve academic performance. This work emphasizes the relationship between schemata and reading strategies (Pressley, 2000). (2) Schemata help readers make inferences by connecting the dots between the information provided in the text and what they already know. This involves filling in gaps and interpreting implicit information. (3) Readers use schemata to monitor their understanding. When the text does not align with their activated schemata, it signals a potential comprehension problem, leading readers to reevaluate their interpretation. (4) Schemata assist in summarizing text by helping readers identify key points and central ideas based on their prior knowledge (Palincsar & Brown, 1984). (5) Readers make connections between the text and their schemata to relate the information to their personal experiences, which enhances comprehension and engagement (Carr & Shu, 1990). Schemata's influence on comprehension strategies underscores the dynamic nature of reading comprehension. The interplay between prior knowledge and the application of comprehension strategies is fundamental to readers' ability to construct meaning from text. Understanding this relationship is crucial for educators and researchers seeking to enhance reading instruction and promote effective reading strategies.

III. METHODOLOGY

3.1. Research Design:

To investigate the roles of schemata in reading comprehension, a mixed-methods research design would be suitable. This mixed-methods research design allows for a comprehensive exploration of the roles of schemata in reading comprehension, encompassing both quantitative assessments of reading comprehension scores and qualitative insights into the cognitive processes at play during comprehension. The research question specifically addresses the impact of schema activation, individual differences, and text characteristics, making it a well-rounded study in the field of reading comprehension.

3.1.1. Quantitative Phase: Experimental Research

Participants: A group of 68 participants, such as students from different two classes were selected to participate in the experiment. These participants were identified their preferred learning styles as *Visual learners, Auditory learners, Group learners, and Individual learners*. The frequencies of the participants can be summarized in the table 1 below. The independent variable was defined as schema activation with two levels: with and without activation. The dependent variable was reading comprehension scores.

Table 1: the frequencies of participants by learning styles

Learning style		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Visual learners	**12**	17.6	17.6	17.6
	Auditory learners	**23**	33.8	33.8	51.5

Group learners	**19**	27.9	27.9	79.4
Individual learners	**14**	20.6	20.6	100.0
Total	**68**	100.0	100.0	

Procedure

Randomly assign participants to two groups; one with schema activation (experimental group, 32 students) and one without schema activation (control group, 34 students). Provide both groups with a reading passage. The schema activation group receives a brief introduction or pre-reading activity to activate relevant schemata related to the text. Both groups complete a reading comprehension assessment.

Data Collection

Collect quantitative data on reading comprehension scores for both groups.

Data Analysis

A statistical analysis ANOVA was used to compare the reading comprehension scores between the two groups; experimental and control groups.

3.1.2. Qualitative Phase

Participants:

Select a subgroup of participants from the quantitative phase to participate in think-aloud protocols. Think-aloud protocols are a research methodology used to gather insights into the cognitive processes that individuals use when engaging in a specific task, such as reading comprehension. These protocols involve participants verbalizing their thoughts as they work through a task, providing researchers with valuable information about their thought processes and strategies. When conducting think-aloud protocols in a reading comprehension context, the goal is to capture the reader's internal dialog, including their reactions to the text and the strategies they employ.

Procedure:

Administer think-aloud tasks where participants verbalize their thought processes while reading a text with and without schema activation.

Data Collection:

Record and transcribe participants' think-aloud sessions.

Data Analysis:

Thematic analysis of the think-aloud transcripts was conducted to explore the cognitive processes involved in reading comprehension and the influence of schema activation.

Integration of Quantitative and Qualitative Data:

In the discussion section, integrate the quantitative findings (impact of schema activation on reading comprehension scores) with the qualitative insights (cognitive processes and strategies used by participants). This will help provide a comprehensive understanding of how schemata affect reading comprehension.

IV. FINDINGS

Descriptive Statistics

Introduction

Summary statistics were calculated for each interval and ratio variable. Frequencies and percentages were calculated for each nominal variable.

Frequencies and Percentages

The most frequently observed category of Learning style was Auditory ($n = 23$, 33.82%). Frequencies and percentages are presented in Table 2.

Table 2: Frequency Table for Nominal Variables

Variable	*n*	*%*
Learning style		
Visual	12	17.65
Auditory	23	33.82
Group	19	27.94
Individual	14	20.59
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

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Summary Statistics

The observations for Experimental group had an average of 6.89 (SD = 0.68, SE_M = 0.08, Min = 5.60, Max = 8.20, Skewness = 0.41, Kurtosis = -0.12). The observations for Control_group had an average of 4.65 (SD = 0.83, SE_M = 0.10, Min = 2.80, Max = 6.50, Skewness = 0.43, Kurtosis = -0.09). When the skewness is greater than 2 in absolute value, the variable is considered to be asymmetrical about its mean. When the kurtosis is greater than or equal to 3, then the variable's distribution is markedly different than a normal distribution in its tendency to produce outliers (Westfall & Henning, 2013). The summary statistics can be found in Table 3.

Table 3: Summary Statistics Table for Interval and Ratio Variables

Variable	M	SD	n	SE_M	Min	Max	Skewness	Kurtosis
Experimental group	6.89	0.68	68	0.08	5.60	8.20	0.41	-0.12
Control group	4.65	0.83	68	0.10	2.80	6.50	0.43	-0.09

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.

ANOVA

Introduction

An analysis of variance (ANOVA) was conducted to determine whether there were significant differences in Experimental group by learning style.

Assumptions

Normality. The assumption of normality was assessed by plotting the quantiles of the model residuals against the quantiles of a Chi-square distribution, also called a Q-Q scatterplot (DeCarlo, 1997). For the assumption of normality to be met, the quantiles of the residuals must not strongly deviate from the theoretical quantiles. Strong deviations could indicate that the parameter estimates are unreliable. Figure 1 presents a Q-Q scatterplot of model residuals.
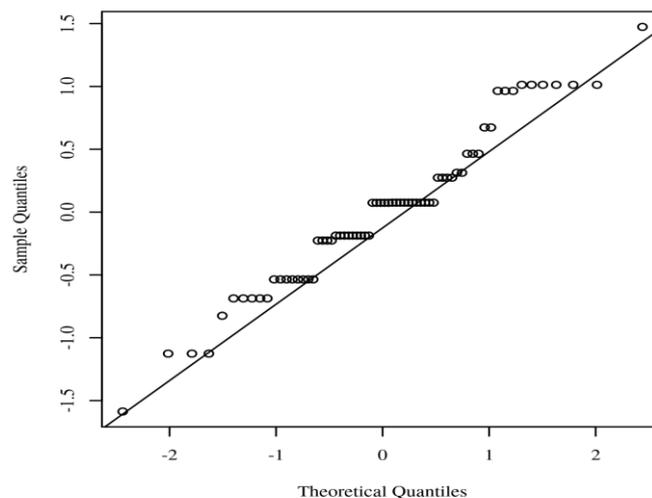

Figure 1: Q-Q scatterplot for normality of the residuals for the regression model.

Homoscedasticity. Homoscedasticity was evaluated by plotting the residuals against the predicted values (Bates et al., 2014; Field, 2017; Osborne & Walters, 2002). The assumption of homoscedasticity is met if the points appear randomly distributed with a mean of zero and no apparent curvature. Figure 2 presents a scatterplot of predicted values and model residuals.
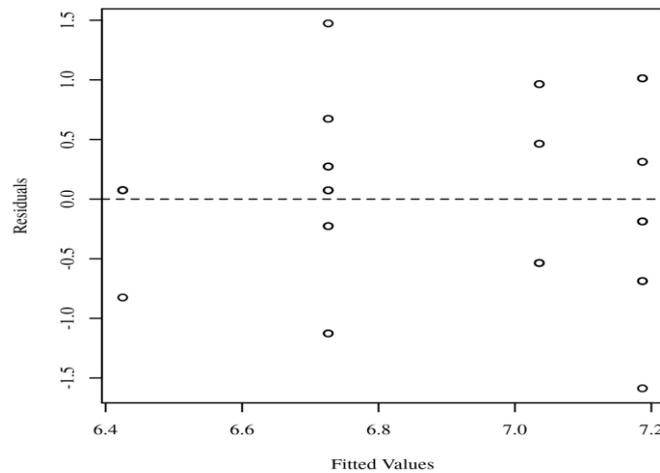
Figure 2: Residuals scatterplot testing homoscedasticity

Outliers. To identify influential points, Studentized residuals were calculated and the absolute values were plotted against the observation numbers (Field, 2017; Pituch & Stevens, 2015). Studentized residuals are calculated by dividing the model residuals by the estimated residual standard deviation. An observation with a Studentized residual greater than 3.22 in absolute value, the 0.999 quantile of a t distribution with 67 degrees of freedom, was considered to have significant influence on the results of the model. Figure 3 presents the Studentized residuals plot of the observations. Observation numbers are specified next to each point with a Studentized residual greater than 3.22.
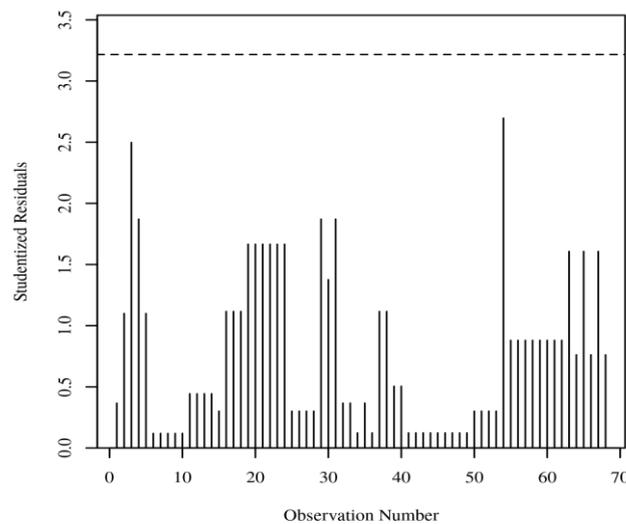

**Figure 3: Studentized residuals plot for outlier detection**

Results
The ANOVA was examined based on an alpha value of .05. The results of the ANOVA were significant, $F(3, 64) = 4.55$, $p = .006$, indicating there were significant differences in Experimental group among the levels of Learning style (Table 3). The eta squared was 0.18 indicating Learning_style explains approximately 18% of the variance in Experimental_group. The means and standard deviations are presented in Table 4.

Table 4: Analysis of Variance Table for Experimental group by learning style

Term	SS	df	F	p	η_p^2
Learning style	5.43	3	4.55	.006	0.18
Residuals	25.44	64			

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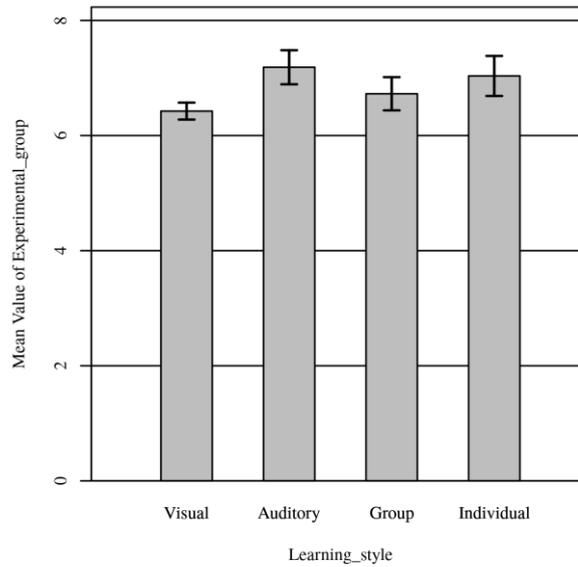
Figure 4: Means of Experimental group by learning style with 95.00% CI Error Bars

Table 4: Mean, Standard Deviation, and Sample Size for Experimental group by Learning style

Combination	*M*	*SD*	*n*
Visual	6.42	0.26	12
Auditory	7.19	0.72	23
Group	6.73	0.64	19
Individual	7.04	0.66	14

Note. A '-' indicates the sample size was too small for the statistic to be calculated.

Post-hoc

A *t*-test was calculated between each group combination to further examine the differences among the variables based on an alpha of .05. The Tukey HSD p-value adjustment was used to correct for the effect of multiple comparisons on the family-wise error rate. For the main effect of Learning_style, the mean of Experimental_group for Visual ($M = 6.42$, $SD = 0.26$) was significantly smaller than for Auditory ($M = 7.19$, $SD = 0.72$), $p = .006$. No other significant effects were found.

V. CONCLUSIONS

In conclusion, this research has provided valuable insights into the roles of schemata in reading comprehension. The following key findings and implications can be drawn from the study. The study reaffirms that schemata are foundational in the comprehension of written text. Readers actively engage their prior knowledge and experiences to facilitate comprehension, including making predictions, inferences, and connections to the text. The research underscores the dynamic and interactive nature of reading comprehension. Schemata not only influence comprehension but are also modified and adapted based on the information encountered in the text. Schemata influence various comprehension strategies, including prediction, inference, monitoring, summarization, and making connections. The study highlights the flexibility and versatility of schemata in supporting comprehension. The findings have important implications for education. Educators can use this knowledge to inform reading instruction and promote effective comprehension strategies. Recognizing the role of schemata can guide the development of curricula that cater to diverse learner needs. While this research provides valuable insights, there is ample room for further investigation. Future research may explore the impact of various types of schemata on comprehension, the role of schema activation in different text genres, and the development of schema-based reading interventions.

In conclusion, this study reinforces the pivotal role of schemata in reading comprehension and the diverse applications of schemata in the interpretation of written text. The implications of this research extend to educators, curriculum developers, and researchers, who can leverage this knowledge to enhance reading instruction and promote a deeper understanding of the cognitive processes involved in comprehension. Furthermore, the findings pave the way for continued exploration of schemata in reading, offering promising directions for future research in the field.

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