**Literature Review on ER Diagrams Understandability**

**Submitted by**

**Submitted to**

**Dated**

**ER Diagrams Understandability**

**Introduction**

The main aim of this literature review is to provide comprehensive detail with concise analysis regarding existing research by identifying gaps in current literature and evaluate understandability and challenges linked with ER diagrams. Based on this, three research questions in this review will be evaluated in detail these questions include, a) Highlight about main findings and key points taken from previous Eye-tracking experiments and ER diagram studies. b) Some comprehensive information about current challenges and limitations presented in ER diagram understandability. c) Suggestion and identification about various areas of ER diagram research that is explored extensively.

The literature review is divided into 2 parts in which the first part is discussed about studies that influence comprehension of concept model, process diagram and ERD. Moreover, the second part will discuss about use of eye-tracking experiments for the comprehension on ERD model, and use of eye-tracking in comprehension of diagrams.

**Literature Review**

**Part A**

In the next paper, author had discussed about the understanding about ERD diagram by taking insights from eye tracking data. For this, the author had used experiment environment for understanding the behavior of software engineers during understanding and designing all representations. The author had evaluated the performance of software engineers during the process of EDR defect detection. Lastly, the results were providing important recommendations for the researchers for future research (Tokdemir & Nergiz Ercil Cagiltay, 2012).

In another paper, the author had discussed about modeling difficulties in creating conceptual data models. According to this, the author had analyze about audiovisual protocols of the individual modelers and modeling processes that were employed through modeling software tools and survey data of modelers. The required study presented by author is exploratory in which author had identified eight types of modeling difficulties about modelling entity types, relationship types, generalization hierarchies and cardinalities. The results were showing that the identified type of modeling difficulties is providing complete information regarding the data modeling processes and they are also used for informing design science research (Rosenthal, Strecker, & Snoeck, 2023).

In another paper, the author Geoffrey, (2004) had inspect pictures taken for information for verifying a sentence. For conducting this research the author had conducted two experiments by using eye-tracking technology for measuring the eye movement of participants. The required sentences were related to true and false only. Based on this, the author had manipulated the type of encoding and search for task verification. The results were showing that various types of encoding had a huge impact on the eye movement patterns of the participants. However, the accuracy and time of participants may varied based on the truth value of the sentence interaction between search and encoding (Geoffrey Underwood, 2004).

According to this research, the author had validated and defined metrics for assessing the understandability of entity-relation diagram. For this, the author had conducted a controlled experiment. Through this, the author had measured response time, accuracy and its subjective ratings of the diagram. The author had calculated all values of proposed metrics used for each diagram and statistical analysis is performed too. The results were showing that the required proposed metrices are correlated significantly with the accuracy, response time and subjective rating of the performance. Another point is that the metrics are highly consistent and stable across various participants and diagram and that is showing the reliability of the metrics (Genero, Poels, & Piattini, 2008).

In this paper, the author had provided valuable information regarding the performance and analysis about non-formal inspection of ERD. For obtaining required results, author had conducted a controlled experiment with 24 software engineers. For this, author ha used eye-tracking technology for recording eye movements of the participants during inspection process. Moreover, author had measured about the defect detection performance. The results were showing that due to high complexity of ERD, there is a huge effect on detecting performance, the number of false positive, and the number of defects detected. Furthermore, when participants used other search patterns, the ideal results were obtained. Due to this, the author had identified four main types of search patterns (Cagiltaya & Gul Tokdemir b, 2013).

In another paper, the author had shared some valuable information regarding comprehension of diagram syntax for this empirical study presented by the author. Based on this, the results were showing that SSADM technique is highly concise and less ambiguous. Furthermore, eye-tracking had revealed various patterns of visual association and attention present between these two notions (Purchasea, Wellanda, & McGill, 2004).

**Part B**

In this paper, the author had talked about the advantage of eye-tracking and EEG for studying about mental processing demands during learning of text-picture combinations. The author had showed that when eye-tracking and EEG frequency is use and combine with band power as process measures, then mental processing demands during learning of text-picture combination is improved. However, during the mismatch condition, the pictorial and textual condition is elaborated and showing identical respective complementary. Therefore, the results were showing that EEG alpha and theta frequency is ideal that provided extended eye-tracking measures with respective measurements. Secondly, author had performed a fixation-related EEG frequency bandwidth analysisthat had showed important results regarding the complex multimedia task materials (Scharinger, Schüler, & Gerjet, 2022).

Based on these points, the author Sharaf et. al had discussed about eye-tracking metrics applied in software engineering. For this, the author had provided awareness to the use of various metrics with some important practical recommendation. The author had compared and contrast some eye-tracking metrics used in software engineering. Lastly, author had proved some important definitions for common metrices and discuss them (Sharaf, Timothy Shaffer, & eneuc, 2015).

In another paper, the author had discussed about the main characteristics of eye movement used for reading and other tasks. the size and shape of the perceptual span. Also, integration the whole information across fixations and saccades. Some important factors that are influencing eye movement control and the individual differences applied on eye movement behavior. Lastly, the author had presented the applications of eye movement research for future technology(Jr, 2016).

In this paper, the author had identified learning style by using eye tracking technology applied in adaptive learning system. For obtaining results, the author had conducted an experiment with 30 participants who were using adaptive learning system known as ALS-ET for learning about the topic data structures. Furthermore, ALS-ET is used for eye tracking technology for monitoring the eye movement and its learning style according to Felder-Silverman model. Furthermore, the learning style is consisted of four main dimensions and it was involved in adapting the learning sources based on inferred learning style of each participant. Secondly, for evaluating the effectiveness level, the author had used two measures. The results were showing that the participants had showed the accuracy of 86.67%. Such participants that are using ALS-ET contains high learning performance with good learning satisfaction after comparing with non-adaptive learning systems. Therefore, eye tracking technology is highly useful for identifying various learning style of learners and provide them with personalized learning(Guabassi, Zakaria Bousalem, & jellouli, 2019).

In this book, author had discussed a lot of points. The main aim of this book is to show some points related to quality and its aspects applied in various fields like machine learning, software quality engineering, human and artificial intelligence, process modeling, improvement and assessment, software quality, quality aspects in quantum computing, privacy, safety, security, ICT verification and validation, and agile, RE, and MDD (Piattini & Paulo Rupino da Cunha, 2021).

In another research, the author had used eye tracking method for exposing cognitive processes in understanding conceptual models. For this, the author had conducted about two experiments by using eye tracking technology. The results were showing that the eye-tracking data contained various cognitive processes for the participants so they can understand the models in detail like visual association, attention, and cognitive integration. The author had found that the complexity of the model is extremely high and through eye-tracking it is simple to gain valuable insights into the cognitive processes (Boot & Cheryl L. Dunn, 2022).

The paper had provided valuable insights about the understandability of process models with extensive research for eye-tracking. The author had evaluated the features by conducting the experiments and they are reliable for interactive process models and also used for extracting meaningful insights(Abbad-Andaloussi & Daniel Lübke, 2023).

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