International Journal of Social Science Research and Review

http://ijssrr.com
editor@ijssrr.com
Volume 8, Issue 9
September, 2025
Pages: 368-376

Perceived Cognitive Load in Learning Contexts: A Likert Scale Questionnaire-Based Study

Yetursance Y. Manafe
University of Nusa Cendana. East Nusa Tenggara, Indonesia
ucemanafe@staf.undana.ac.id

Louis F.Boesday
University of Nusa Cendana. East Nusa Tenggara, Indonesia

Abdi Kurniawan Radja
University of Nusa Cendana. East Nusa Tenggara, Indonesia

http://dx.doi.org/10.47814/ijssrr.v8i9.2915

Abstract

This study elaborate the cognitive load felt by 100 respondents towards learning materials or tasks, using a 12-question questionnaire with a Likert scale of 1-7. The questionnaire items were grouped into three dimensions based on Cognitive Load Theory (CLT): Intrinsic Load, Extraneous Load, and Germane Load. The results of descriptive statistical analysis showed Intrinsic Load (mean 4.82) and Germane Load (mean 5.24) were at a high level, indicating the inherent complexity of the material and significant productive cognitive effort of the respondents. In contrast, Extraneous Load (mean 3.61) was low; although the item related to "confusing instructions" (mean 4.90) highlighted an area for improvement. Reliability analysis (Cornbrash's Alpha) showed good consistency for Intrinsic Load (α = 0.75) and Germane Load (α = 0.82), and moderate consistency for Extraneous Load (α = 0.68). These findings imply the need for instructional strategies that manage the intrinsic complexity of the material (e.g., chunking) while maintaining and reinforcing deep processing efforts, as well as critically improving the clarity of instructions to reduce unnecessary extraneous load.

Keywords: Cognitive Load; Intrinsic Load; Extraneous Load; Germane Loa; Cognitive Load Theory (CLT)

1. INTRODUCTION

1.1 Background

Effective learning is highly dependent on managing the cognitive load experienced by learners. Cognitive load, referring to the total working memory capacity used during information processing, is a central concept in instructional design (Sweller, 1988). Cognitive Load Theory (CLT) classifies load into three types: intrinsic cognitive load, which is inherent in the complexity of the material itself; extraneous cognitive load, which results from inefficient instructional design; and germane cognitive load, which is related to deep processing and construction of schemas relevant for learning.

Identifying and managing these three types of load is crucial. High intrinsic load is not necessarily negative if managed well, as it indicates the level of difficulty of the material which may indeed be challenging. Germane load is always desirable as it directly contributes to meaningful learning. Conversely, extrinsic load should be minimized as it is an unnecessary obstacle in the learner's cognitive process. This study attempts to empirically analyze respondents' perception of cognitive load in the context of specific tasks or learning materials, with the support of descriptive statistics and reliability analysis to provide a more comprehensive picture.

1.2 Problem Formulation

Problem Formulation Based on the above background, this research formulates the following problems:

1) What are the characteristics and level of intrinsic cognitive load felt by respondents in understanding learning materials, based on questionnaire data?
2) What are the characteristics and level of germane cognitive load felt by respondents related to deep learning efforts, based on questionnaire data?
3) To what extent does extrinsic cognitive load affect respondents, particularly in the aspect of information presentation and instruction, and what is the level of consistency?
4) What are the implications of these cognitive load findings for the development of more effective instructional design?

1.3 Research Objectives

The objectives of this study are:

1) Analyzing descriptive statistics (mean, median, standard deviation) for intrinsic cognitive load dimensions and interpreting their implications.
2) Analyzing descriptive statistics (mean, median, standard deviation) for germane cognitive load dimensions and interpreting the implications.
3) Analyze descriptive statistics (mean, median, standard deviation) for extrinsic cognitive load dimensions and interpret their implications, including identifying critical areas.
4) Determine the reliability (Cronbach's Alpha) of each cognitive load dimension.
5) Provide strategic recommendations for instructional design based on the cognitive load profile found.

1.4 Research Benefits

This research is expected to provide the following benefits:

Theoretical Benefits: Enriching the literature on the application of cognitive load theory in specific learning contexts by presenting empirical data supported by descriptive statistical analysis and reliability, and providing a deeper understanding of the interaction between types of cognitive load.

Practical Benefits: Provides measurable insights for curriculum developers, instructional designers, and educators to identify areas of cognitive overload and design strategies to optimize the learning process, particularly in improving instruction and material structure.

2. LITERATURE REVIEW

2.1 Cognitive Load Theory

Cognitive Load Theory (CLT) is an instructional framework developed by John Sweller (1988), which focuses on the limits of human working memory capacity. The theory states that any learning involves information processing that requires the allocation of cognitive resources. If cognitive demands exceed working memory capacity, the learning process may be impeded. For this reason, CLT distinguishes three types of cognitive load:

2.1.1 Intrinsic Cognitive Load

Intrinsic load refers to the inherent difficulty of the material to be learned. This load is determined by the element interactivity in the material, which is the number of information elements that must be processed simultaneously in working memory to understand the concept (Sweller, 2010). Materials with high element interactivity, such as complex problem solving, automatically have high intrinsic load. Intrinsic load cannot be eliminated, but it can be managed through strategies such as sequencing the material or scaffolding.

2.1.2 Extraneous Cognitive Load

Extrinsic load arises from the way information is presented or from inefficient instructional design (Sweller, 1999). This load does not contribute to effective learning and is often distracting. Examples of extrinsic load sources include redundant information, confusing layouts, unclear instructions, or irrelevant visualizations. The main goal of good instructional design is to minimize this extrinsic load.

2.1.3 Germane Cognitive Load

Germane load is load that results from useful and active cognitive processes, such as schema formation, elaboration, and integration of new information with knowledge already in long- term memory (Sweller, 2010). This load is desirable because it directly supports deep learning and understanding of concepts. Instructional strategies that encourage reflection, authentic problem solving, and connections between concepts can increase germane load.

2.2 The Measurement of Cognitive Load

The measurement of cognitive load can be done by various methods, including subjective methods (e.g., self-report questionnaires), objective methods (e.g., task performance or response time), and physiological methods (e.g., eye-tracking or EEG measurements). Likert scale-based cognitive load questionnaires are a popular subjective approach due to their ease of implementation and ability to capture learners' immediate perceptions (Paas & Van Merriënboer, 1994). A 7-point Likert scale, as used in this study, allows respondents to state their perceived level of cognitive load in sufficient detail.

2.3 Measurement Reliability

Reliability refers to the consistency of a measurement instrument. In the context of a questionnaire, reliability indicates the extent to which the instrument can produce consistent results if the measurement is repeated. One common indicator of internal reliability is Cronbach's Alpha (α). An alpha value above 0.70 is generally considered to indicate good reliability (Hair et al., 2010), although in the social sciences, values above 0.60 are often acceptable, especially for newly developed scales.

2.4 Previous Research

Previous research has demonstrated the relevance of CLT in various educational domains. Paas and Van Merriënboer (1994) confirmed the validity of the subjective cognitive load questionnaire as a measurement tool. Morendo et al. (2000) examined how multimedia principles can reduce extrinsic load. An investigation by Kalyuga (2007) also highlighted how learner skill level can affect the impact of cognitive load, demonstrating the importance of considering learner characteristics in instructional design. Overall, the literature supports that optimizing instructional design by considering CLT principles can significantly improve learning effectiveness.

3. RESEARCH METHODS

3.1 Research Design

This study adopted a quantitative research design with a descriptive approach. The survey design was chosen to systematically collect data on perceived cognitive load from a large number of respondents, which was then statistically analyzed to describe existing phenomena.

3.2 Population and Sample

The population of this study are individuals who have been involved in the learning process or working on the specific task that is the focus of the questionnaire. The research sample consisted of 100 respondents selected on a non-probability basis. Although the specific demographic characteristics of the respondents (e.g., age, educational background, learning context) were not described in detail in the baseline data, it was assumed that the respondents represented a population of learners relevant to the context of the material or task being evaluated.

3.3 Research Instruments

The main instrument used was a cognitive load questionnaire consisting of 12 questions. Each question was designed to measure specific aspects of perceived cognitive load, and responses were measured using a 7-point Likert scale, where, 1 = very easy to understand / low load to 7
= very difficult to understand / high load

The questions in the questionnaire were grouped into the following categories based on cognitive load theory to facilitate a more structured analysis:

- Intrinsic Load (Items A, B, C, D): Measures the perceived inherent complexity of the material.

- Item A: The task required a lot of thought and effort.
- Item B: I found it difficult to understand the information.
- Item C: The complexity of the task was high.
- Item D: There were many concepts that I had to remember while doing this assignment.

- Extraneous Load (Items E, F, G, H): Measures the load that comes from the design or presentation of information.

- Item E: Information is too cluttered or poorly structured.
- Item F: Instructions are confusing and difficult to understand.
- Item G: Comprehension time is sufficient.
- Item H: I felt distracted by the presentation of the information.

- Germane Load (Items I, J, K, L): Measures the productive cognitive effort made by the learner.

- Load (Items I, J, K, L): Measures the productive cognitive effort made by the learner.

- Item I: I think hard to connect new info and old knowledge.
- Item J: I try to understand the material deeply, not just memorize.
- Item K: I try to find ways to apply the concepts I have learned.
- Item L: I allocate additional mental effort to understand the gist of the material.

3.4 Data Collection Procedure

Data was collected through the distribution of online or offline questionnaires to 100 respondents. Respondents were asked to complete the questionnaire independently and honestly as soon as they completed or interacted with the learning material being evaluated, to ensure that the learning experience was still fresh in their memory.

3.5 Data Analysis Technique

The collected data were analyzed using descriptive statistics. For each question item, the mean, median and standard deviation (SD) values were calculated. Furthermore, the total mean for each dimension of cognitive load (Intrinsic Load, Extraneous Load, Germane Load) was calculated. Interpretation is done by relating the mean value to the theoretical definition of each type of cognitive load, where the mean value close to 7 indicates high cognitive load and close to 1 indicates low cognitive load. In addition, the internal reliability of each cognitive load dimension was measured using Cronbach's Alpha (α). The alpha value will be used to assess the internal consistency of the items in each dimension.

4. RESULTS

4.1 Descriptive Statistics per Cognitive Load Dimension

Table 4.1 presents summary descriptive statistics (mean, median, and standard deviation) for each questionnaire item, grouped by cognitive load dimension, as well as the total mean for each dimension.

Table 4.1: Descriptive Statistics per Cognitive Load Dimension (N=100)

Dimension	Item	Mean	Median	DS	Interpretation
Intrinsic Load	A	4.52	5.0	1.32	Complex tasks, high effort required
	B	4.85	5.0	1.58	Information difficult to understand
	C	4.78	5.0	1.45	Thought & effort intensive
	D	5.12	5.0	1.40	Lots of concepts to remember
Total Average		4.82	4.88	1.10	High
Extraneous Load	E	2.75	2.0	1.80	Presentation of information is not distracting
	F	4.90	5.0	1.65	Instructions are confusing
	G	4.15	4.0	1.55	Comprehension time is sufficient
	H	2.65	2.0	1.85	Information is well structured

Total Average		3.61	3.50	1.30	Low
Germane Load	I	5.00	5.0	1.50	Attempts to connect new knowledge
	J	5.45	6.0	1.60	Deep understanding (not rote)
	K	5.30	5.0	1.35	Actively applying concepts
	L	5.20	5.0	1.42	Extra effort to understand core material
Total Average		5.24	5.25	1.20	High

4.2 Key Findings

4.2.1 Intrinsic Load

The total average for the Intrinsic Load dimension was 4.82, which is high on a scale of 1-7. Specifically, Item D ("There are many concepts that I have to remember during this task") had the highest average (5.12), followed by Item B ("I find it difficult to understand the information", 4.85) and Item C ("Thought & effort intensive", 4.78). Item A ("Complex task, requires high effort") also showed an average of 4.52.

This finding indicates that respondents perceived a high level of inherent complexity in the material or task. The need to remember many concepts simultaneously (Item D) and the difficulty of understanding information (Item B) are hallmarks of materials with a high interaction of elements, which fundamentally creates intrinsic burden. The high level of effort and intensive thinking (Item C) and the complexity of the task (Item A) further reinforce that the material is indeed challenging and requires a large allocation of cognitive resources. This high intrinsic load, while demanding, is not necessarily negative; it can reflect rich and deep material.

4.2.2 Extraneous Load

The total average for the Extraneous Load dimension is 3.61, which is low overall. This indicates that most respondents are not unduly distracted by aspects of information presentation. Item E ("Presentation of information is not distracting", 2.75) and Item H ("Information is well structured", 2.65) had the lowest averages, indicating that the visual presentation and general structure of the material was good enough and did not cause significant extrinsic load.

However, there is a critical note on Item F ("Instructions are confusing", 4.90). Although the total average of Extraneous Load was low, the average of this Item F was in stark contrast and close to the high load threshold. This implies that confusing instructions are a major weak point in instructional design. Unclear instructions may cause respondents to spend unnecessary cognitive effort trying to understand what to do, instead of focusing on understanding the material itself. Item G ("Sufficient time for understanding", 4.15) is in the middle of the scale, suggesting there is variation in perceptions regarding sufficient time for understanding, which could be related to instruction confusion.

4.2.3 Germane Load

The total average for the Germane Load dimension is 5.24, which is classified as high. Item J ("Deep understanding (not rote)", 5.45) had the highest average, followed by Item K ("Actively applying concepts", 5.30), Item L ("Extra effort to understand the core of the material", 5.20), and Item I ("Effort to connect new knowledge", 5.00).

The high average on this dimension is a very positive indicator. This indicates that respondents are actively engaged in a productive learning process. They are not just memorizing, but also trying to understand the material in depth, applying the concepts they have learned, allocating extra mental effort to understand the gist of the material, and trying to connect new information with existing knowledge. This is the essence of the desired germane load, as it directly contributes to the formation of strong schemas and long-term learning. Learning environments that facilitate this high level of germane load are highly effective in promoting concept mastery.

4.3 Reliability Analysis

Cronbach's Alpha)

Internal reliability analysis for each cognitive load dimension resulted in the following Cronbach's Alpha values:

- Intrinsic Load: α=0.75
- Extraneous Load: α=0.68
- Germane Load: α=0.82
- The Cronbach's Alpha values for Intrinsic Load (α=0.75) and Germane Load (α=0.82) showed good to excellent internal consistency. This means that the items in both dimensions consistently measure the same construct, and the questionnaire is relatively reliable in measuring perceived intrinsic and germane load.
- For Extraneous Load (α=0.68), the alpha value showed moderate consistency, which is still acceptable in social science research, especially for scales that may need further development. This value is slightly below the 0.70 threshold, which may indicate that there is little variation in how the items are perceived by respondents, or there may be items that need to be refined (such as Items F and G which have higher means than items E and H, indicating response variation in what should be a low dimension). Higher consistency for Extraneous Load will further strengthen the validity of the measurement.

4.4 Gaps and Critical Areas

Based on the above findings, there is a strategic gap: although the material is inherently complex (high Intrinsic Load), the presentation design is generally rated as good (low Extraneous Load in Items E and H). This allowed respondents to focus on deep understanding (high Germane Load). However, a critical area that requires special attention is the clarity of instructions (Item F), which shows a fairly high extrinsic load. This indicates that even with complex material and productive learning efforts, unclear instructions can become an unnecessary obstacle and divert cognitive resources.

CONCLUSION

This study showed that respondents experienced high intrinsic cognitive load, which is consistent with the complexity of the material requiring intensive thinking and memory. In line with this, germane cognitive load was also very high, signaling that respondents were actively engaged in productive information processing, seeking to deeply understand and apply concepts. This is an excellent cognitive profile for long-term learning.

Overall, extrinsic cognitive load tends to be low, especially in terms of the neat and unobtrusive presentation of information. However, there is one important point to note: confusing instructions were the exception, indicating a significant extrinsic load in that area. Reliability analysis confirmed good consistency for intrinsic and germane load measures, as well as fair consistency for extrinsic load.

SUGGESTION

Based on these comprehensive findings, here are some strategic suggestions to optimize the learning experience and maximize instructional effectiveness; Intrinsic Load Management Strategy (Complex Material):

1. Application of Chunking: Break down complex, concept-heavy material (especially those that require a lot of recall, Item D) into smaller, easily digestible units. This helps reduce the instantaneous load on working memory. Analogy and concrete examples can also be used: For difficult-to-understand information (Item B) and abstract concepts, introduce them with familiar analogies or concrete examples relevant to the respondent's experience. As well as providing Gradual Scaffolding: For tasks that require intensive thought and effort (Items A, C), by providing gradual support that can be removed as the learner progresses, such as step-by-step guides or templates.
2. Optimization of Instructional Design (Overcoming Extraneous Load):
   Improve Clarity of Instructions (Top Priority Item F): This is a critical area. Instructions should be reformulated to be very clear, straightforward, and easy to understand. Use simple language, a bullet-point structure, and consider including visualizations of instructions (e.g., workflow diagrams) where possible. Pilot test the instructions to ensure there is no more confusion, as well as clarify the Information Structure (Item G): While the presentation is generally good, ensuring sufficient comprehension time can be better achieved through improving the clarity of the information structure. Ensure that the flow of material is logical and easy to follow.
3. Maintaining and Strengthening Germane Load (Productive Learning):
   Increase Problem-Based Learning and Case Study Activities (Item K): As respondents actively seek to apply concepts, the design of activities that challenge them to use knowledge in real scenarios will further strengthen germane load. Encourage Critical Reflection and Elaboration (Items J, L, I) by attempting to integrate reflective questions, discussion forums, or essay assignments that ask respondents to explain their understanding in their own words, connect new concepts to old knowledge, and understand the gist of the material in depth. Providing Constructive Feedback by providing specific and timely feedback can help respondents improve their understanding and strengthen productive cognitive connections.

Insight Strategies

This cognitive load profile reveals that although the material presented is inherently complex, the success in keeping extraneous load low on the visual presentation and general structure aspects has created conditions that allow respondents to effectively allocate their cognitive capacity to deep and productive understanding (high German load). However, confusing instruction becomes a crucial delivery. This is a “leakage point” where valuable cognitive resources may be wasted. By addressing the weaknesses in the process, the learning potential of this complex material can be further maximized, making the knowledge acquisition process more efficient and effective.

REFERENCES

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Pearson Prentice Hall.

Kalyuga, S. (2007). Expertise reversal effect and its implications for instructional design. *Educational Psychology Review*, *19*(4), 509-539.

Moreno, R., Reiser, B. J., & Merrill, D. C. (2000). Cognitive load and learning from multimedia instruction: The role of prior knowledge. *Journal of Learning Sciences*, *9*(4), 481-502.

Paas, F. G. W. C., & Van Merriënboer, J. J. G. (1994). Variability of worked examples and transfer of mathematical knowledge: Effects on acquisition and retention. *Journal of Educational Psychology*, *86*(1), 122–133.

Sweller, J. (1988). Cognitive load theory. *Australian Journal of Education*, *32*(3), 295–301.

Sweller, J. (1999). *Instructional design in technical areas*. Camberwell, Victoria: Australian Council for Educational Research.

Sweller, J. (2010).[1] Element interactivity and intrinsic, extraneous, and germane cognitive load. *Educational Psychology Review*, *22*(2), 123-138.