Journal of Educational Leadership and Management
Volume 8, Issue 1, 2026, 29-42,

Assessing the Cognitive Load of Faculty Members in Online Exam Marking at the Virtual University of Pakistan

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Abstract

This study aimed to check the investigates the cognitive load experienced by faculty members during online exam marking at the Virtual University of Pakistan. The current research followed Cognitive Load Theory (CLT) as a guiding framework. Sequential explanatory mixed-method design was employed in current research. Structured questionnaire measuring intrinsic, extraneous and Germane burden was used to collect data for quantitative phase from 47 faculty members. Semi-structured interviews were used to gather data from 15 experienced faculty members for qualitative phase. The quantitative data were analyzed by descriptive and inferential statistics and thematic analysis were used for qualitative data analysis. The results of the current study showed that over 70% of respondents observed considerable cognitive and organizational loads during online grading of exam because while examining critical or long responses required more attention and efforts in reporting. The other reasons behind strain and exhaustion was bound to answer keys, organizational workload, time pressure and fixed time limit. While well-structured responses created satisfaction among faculty. It was concluded that online marking burdens of exam is multi-dimensional including technological, mental and temporal elements. It was recommended that to increase the competence and accurateness of faculty in online assessment may be increased by use of AI-assisted marking tools, less rigid grading schedules, good digital interfaces, conducting training workshops and managing workload.

Keywords: *Cognitive Load, Online Exam Marking, Faculty, Virtual University, Digital Assessment, Cognitive Load Theory*

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Introduction

The basic element of academic practices to facilitate the performance and learning of students is assessment (Dixson & Worrell, 2016). The faculty members required substantial mental investment at the Virtual University, because the mode of instruction and evaluation is mainly online and faculty members are highly busy in marking of papers online. The attention of faculty members in online marking process is divided into various tasks such as assessing work of pupils, following fixed criteria and giving feedback to online interfaces. The complex and inconsistent online marking system of Virtual University follow a particular interface and functionality that sometime facilitate and sometimes impede the cognitive progress of their faculty.

Cognitive stress could be minimized by following different inputs i.e., colors and graphics to aid processing in systems (Korbach et al., 2017). These systems can also minimize as well as increase challenges for faculty as it is difficult to navigate online environment (Hamer & Smith, 2021). The interaction of integral capacity of working memory with online interfaces has general influence on the mental ability of faculty members. The well-developed framework of Cognitive Load Theory (CLT) in educational research has highlighted these limits (Sweller, 1988, 2020). The fixed ability of working memory in understanding and processing of the system is based on the principle of CLT (Kalyuga & Liu, 2015). In online marking system, the CLT describe the three cognitive burdens including Intrinsic Load (ICL) which is caused by the difficulty level of the internal exam responses, the second type is Extraneous Load (ECL) caused by difficult interfaces of the online checking systems. Third type is Germane Load (GCL) that emerges due to the fixed judgment standards related to performance of pupils and provision of feedback of high quality. In online grading systems, the main burden is dealing with ICL, reducing ECL and making space for the GCL resources.

The use of digital systems like those used at the Virtual University increased in 2020 after the pandemic of COVID-19, it shifted assessment mainly from traditional to online platforms for faculty (Doreleyers & Knighton, 2020; United Nations, 2020). Digital use of marking system is introduced by this sudden change of modality shift. However, it is still unknown how these systems impact the accuracy and competency of faculty by creating mental burden for them. So, the main purpose of this research is to fill this gap by evaluating the faculty members' cognitive burden faced in online marking at Virtual University. The main aim of this study is to provide support to faculty members by increasing the competency of marking, quality and consistency of assessment process.

This study will provide support to redesign the online assessment system by providing actionable data.

On the basis of literature following objective were made:

1. To examine the level of cognitive load experienced by faculty members in online exam marking at Virtual University
2. To find out the main challenges faculty face during online exam marking and suggest practical strategies to reduce cognitive burden

Literature Review

The need for reassessment practices, specifically in era of online checking in exams have emerged due to the speedy switch of online mode of education. Faculty members have to face distinctive cognitive problems due to the proficiency and scalability of digital platforms. It is essential to understand the mental burden on mentors to improve the quality of assessment results and affectivity of teaching online exam checking. The current research analyzed the challenges of online exam marking by the framework of Sweller (1988), Cognitive Load Theory (CLT). According to CLT, the capacity of working memory is limited. Cognitive burden is divided into three categories i.e., intrinsic, extraneous, and germane. All these three categories have distinct features as intrinsic category deals with the material's inherent difficulty. The presentation of task and execution of memory is linked with the extraneous, and the third category is germane that refers to the understanding of the information and burden arise due to process of mental efforts (Sweller et al., 2011). The reason behind intrinsic burden in online exam marking is from the difficulty of assessing student responses, weakly developed interface or platforms is cause of extraneous load, and exam checker's expertise to correctly grading is due to germane load. Numerous kinds of challenges which faculty members have to face in marking online exams. Maintenance of grading standards constantly, dealing with large number of submissions and navigating difficult digital interfaces are some examples of various challenges in exam marking. According to Skulmowski et al. (20220), such problems may minimize the effective assessment of existing mental resources and raise the extraneous cognitive load. Marking online papers has become time consuming and rationally challenging due to difficult digital interfaces, intense mental pressure, poor structured procedures and superfluous points in startup (Leppink et al., 2014). It is the need of time to develop evidence-based approaches to deal with these problems in online marking of exams. Extraneous mental pressure can be reduced by making digital interfaces simple and removing extra steps in startup of checking exams, and it will automatically allow exam checkers to pay attention on the primary assessment tasks (Leppink et al., 2014). The other way to minimize the mental burden of the faculty and make their performance of online marking effective is to conduct the training workshops by the experts with

clear guidelines and organized strategies (Paas & Van Merriënboer, 2020; Gutiérrez et al., 2023). The time and mental pressure can be reduced by marking objective questions with use of automated tools (Mate, 2021). Moreover, various institutes like the Center for Teaching and Learning at Johns Hopkins University focus on improving efficiency of faculty by reducing barriers and providing technical support (CTL, 2020). There are still gaps in literature despite this insight. Many researchers emphasizes on the mental burden of students in processes of learning in online exams instead of burden faced by the exam checkers cognitively. The number of empirical studies on how online exam platforms particularly pay attention to cognitive load of faculty and what kind of techniques are very useful in alleviating it are limited. It is necessary to conduct further researches to study the distinctive challenges of online exam checker and to introduce targeted interventions which may enhance efficiency of marking by reducing mental burden (Alruwaili, 2025).

To conclude, mental burden on faculty in online exam grading is multi-factor problem with various reasons i.e., difficulty of task, poo interface designs and lack of availability of resources for teachers etc. The significance of reducing extraneous burden and improving instructional and technological design is highlighted by the application by Cognitive Load Theory. Many empirical approaches, i.e., simple interfaces, designed management, workshops and automatic online exam checking tools can be useful to minimize cognitive pressure. On the other hand, it is important to conduct further studies to fill this gap and to enhance the performance of faculty in context of online assessment by providing practical solutions.

Although the current literature has discussed issues related to the cognitive load on students and the overall issues of online assessments, there are very limited studies that have explored the issue of faculty cognitive load in the online marking of examinations, especially about the Global South setting. Incidentally, there is no combined mixed method study that connects survey data and detailed faculty narratives. The proposed study will address these gaps by analyzing the multidimensional cognitive burden on the faculty and providing solutions that can be institutional in nature.

Theoretical Framework

The current research is supported by Cognitive Load Theory (CLT). This theory shows that the capability of working memory is limited and lot of cognitive demands has negative impact on the performance of the task (Sweller, 1988; Sweller et al., 2019). Intrinsic, extraneous, and germane are three different kinds of CLT (Sweller, 2011; Paas & van Merriënboer, 2020). The difficulty of questions and evaluation emerged due to intrinsic load, technical problems, poor marking platforms is reason of extraneous burden in online marking of exam (Chandler & Sweller,

1991). These constructs are operationalized in this study as follows: Intrinsic Load items (e.g. marking long answers) measure the intrinsic load, Extraneous Load (e.g. system usability and administrative burden) are items that measure the extraneous load, and Germane Load (e.g. grading fairness and feedback quality) are items that measure the germane load. This correspondence will be used to make sure that the questionnaire and the interview guide are direct reflections of CLT. The difficulty in evaluating answers, following grading criteria and imitating on pedagogical worth shows germane load (Paas et al., 2003). High intrinsic and extraneous loads can create strain, lack of attention, and exhaustion in mental ability. However, mental engagement is reason of exceed germane load (Sweller et al., 2019). To examine the faculty point of view on mental burden i.e., cognitive stress, lack of attention, poor digital platforms and low cognitive abilities are evaluated by semi-structured interviews (Paas & van Merriënboer, 2020). The efficiency and accuracy of online exam grading can be improved by understanding the causes of mental burdens through evidence-based interventions (Sweller et al., 2019; Paas et al., 2003). In this study the application of CLT provide a theoretical framework for measuring cognitive issues of faculty in online exam marking. In instructional design and educational psychology CLT is aligned with international research standards.

Methodology

The current study applied mixed method research type by using sequential explanatory research design. Population of the study was faculty members of Virtual University. Sample of the study was 62 faculty members of Virtual University. For quantitative phase data was gathered from 47 participants by using convenience sampling technique, and for qualitative phase data was collected from 15 faculty members by using purposive sampling technique. Respondents were sampled from various departments i.e., Education (n=10), Computer Science (n=10), Management Sciences (n=10), Biology (n=5), Mathematics (n=5), and Islamic Studies (n=7). Quantitative data was collected by using structured questionnaire based on cognitive load theory (Sweller, 1988). The theory measure three domain of intrinsic, extraneous, and germane cognitive load. A five-point Likert scale was used for the questionnaire. On the basis of quantitative results, semi-structured interviews were conducted to validate the results of quantitative phase. The main focus of the interview question were on mental tiredness, attention issues as well on tips to reduce the cognitive burden load during online exam marking. SPSS (Version 26) was used to analyze quantitative data by using descriptive and inferential statistics techniques. Braun and Clarke's (2006) six-step method was used to analyze qualitative data by thematic analysis. Data was collected online by institutional emails and Microsoft Teams interviews. Informed consent was obtained to maintain confidentiality of research. The Virtual University's Research Ethics Committee approved the current research. In

current study the participation of respondents were voluntarily. Quantitative and qualitative data set provided deep understanding of the cognitive challenges faculty face in online exam marking.

Results

The results below are given in two combined stages; quantitative survey results (Phase 1) and qualitative interview themes (Phase 2). The qualitative stage clearly explains and interprets the quantitative trends, according to the design of sequential explanations.

Phase-1

Descriptive Statistics for Survey Responses (N=47)

Table 1

Intrinsic Load (Task Complexity)

Statement	SDA n (%)	DA n (%)	Neutral n (%)	A n (%)	SA n (%)
Marking online exams took a lot of effort	15 (31.9)	19 (40.4)	4 (8.5)	7 (14.9)	2 (4.3)
I had to focus hard while marking	12 (25.5)	25 (53.2)	5 (10.6)	4 (8.5)	1 (2.1)
Overall, marking felt mentally heavy	16 (34.0)	19 (40.4)	4 (8.5)	6 (12.8)	2 (4.3)
Higher-level questions (analysis/critical thinking) were harder to mark	14 (29.8)	21 (44.7)	7 \(14.9)	3 (6.4)	2 (4.3)
Long answers made marking difficult	18 (38.3)	19 (40.4)	4 (8.5)	4 (8.5)	2 (4.3)

Table 1 showed that faculty members observed cognitive burden during exam marking online as 70% of the results reported that online grading system is difficult and mentally exhausting. According to the two-thirds of respondents' critical questions needed significant attention to analyze. 80% of the faculty members reported that analyzing long question is too demanding. It was concluded by the results that online assessment is linked with high mental stress, and it suggests the need of experts support to reduce the burden.

Table 2

Extraneous Load (Unnecessary Pressure/Barriers)

Statement	SDA n (%)	DA n (%)	Neutral n (%)	A n (%)	SA n (%)
I felt tired after checking many papers	17 (36.2)	17 (36.2)	5 (10.6)	5 (10.6)	3 (6.4)

Statement	SDA n (%)	DA n (%)	Neutral n (%)	A n (%)	SA n (%)
It was hard to stay focused for long time	16 (34.0)	21 (44.7)	3 (6.4)	5 (10.6)	2 (4.3)
Some answers were unclear to understand	11 (23.4)	17 (36.2)	9 (19.1)	8 (17.0)	2 (4.3)
Time given for marking was not enough	14 (29.8)	15 (31.9)	7 (14.9)	7 (14.9)	4 (8.5)
Deadlines made me feel rushed	17 (36.2)	18 (38.3)	5 (10.6)	4 (8.5)	3 (6.4)
I felt stressed during online marking	14 (29.8)	19 (40.4)	5 (10.6)	7 (14.9)	2 (4.3)
Repeating same type of answers made me tired	9 (19.1)	16 (34.0)	14 (29.8)	6 (12.8)	2 (4.3)

The results of table 2 indicated that online marking among faculty creates significant tiredness and time pressure. Approximately 70% of faculty observed more exhaustion and lack of concentration during marking of paper online. According to the two-thirds of respondents limited time of marking papers create unease among faculty members. Due to the poor procedure half of the respondents feel burden and repetitive format cause stress over half of the respondents in online marking systems.

Table 3

Germane Load (Constructive Effort for Quality)

Statement	SDA n (%)	DA n (%)	Neutral n (%)	A n (%)	SA n (%)
Deciding grades for borderline cases was hard	8 (17.0)	18 (38.3)	12 (25.5)	7 (14.9)	2 (4.3)
It took effort to be fair with all papers	7 (14.9)	17 (36.2)	11 (23.4)	9 (19.1)	3 (6.4)
Giving half marks was difficult	8 (17.0)	17 (36.2)	10 (21.3)	8 (17.0)	4 (8.5)
Well-written answers caused satisfaction	0 (0.0)	0 (0.0)	3 (6.4)	28 (59.6)	16 (34.0)

The results of table 3 indicated that over half of faculty have to face burden regarding borderline decisions and nearly half of faculty have to face burden in maintaining fairness. Partial credit allocation also challenged over half of respondents. Well-written comments were positively reinforced, with 94% of markers satisfied. This strong respect for quality submissions shows how student answer clarity affects faculty confidence during online marking.

One-Sample t-Test Results for Survey Items Against a Neutral Test Value

Table 4

Intrinsic Load (Task Complexity)

Statement	t	df	P	Mean Diff	95% CI Lower	95% CI Upper
Marking online exams took little effort	-3.45	46	.001	-0.64	-1.00	-0.27
I had to focus less while marking	-6.30	46	<.001	-0.83	-1.10	-0.56
Overall, marking felt mentally light	-3.89	46	<.001	-0.68	-1.03	-0.33
Higher-level questions were easier to mark	-4.77	46	<.001	-0.74	-1.05	-0.43
Long answers made marking easy	-4.63	46	<.001	-0.79	-1.14	-0.44

In table 4, results of paired sampled t test revealed that opinion of faculty during online marking is considerably far from neutral in various domains. More effort is required in marking as compared to neutral benchmark (p= .001), the more attention is required for respondents reporting (p< .001). respondents perceived tasks heavier mentally than neutral (p < .001). Additionally higher order and long question were difficult to check (both p < .001), contrary to the idea that these question types make the assessment process easier.

Table 5

Extraneous Load (Unnecessary Pressure/Barriers)

Statement	t	df	p	Mean Difference	95% CI Lower	95% CI Upper
I felt fresh after checking many papers	-3.45	46	.001	-0.64	-1.02	-0.26
It was easy to stay focused for long time	-4.49	46	<.001	-0.74	-1.07	-0.41
All answers were clear to understand	-1.77	46	.083	-0.30	-0.64	0.04
Time given for marking was sufficient	-1.81	46	.077	-0.34	-0.72	0.04
Deadlines made me feel relaxed	-3.82	46	<.001	-0.68	-1.04	-0.32
Repeating same type of answers made me energetic	-2.32	46	.025	-0.38	-0.71	-0.05

Table 5 results revealed that after prolong marking, faculty experience exhaustion instead of freshness (p = .001), have problem in maintaining attention (p < .001). The clear time pressure and deadlines caused strain rather than easing (p <.001). Contrary enhancing energy, repetitive responses led to mental exhaustion (p =.025). The mean scores trended adversely, indicating a tendency toward dissatisfaction in these areas, even when answer clarity and time sufficiency did not differ substantially from neutral.

Table 6
Germane Load (Constructive Effort for Quality)

Statement	t	df	p	Mean Difference	95%CI Lower	95%CI Upper
Deciding grades for borderline cases was easy	-2.38	46	.021	-0.38	-0.71	-0.06
It took little effort to be fair with all papers	-1.17	46	.247	-0.19	-0.52	0.14
Giving half marks was easy	-0.63	46	.529	-0.11	-0.46	0.24
Well-written answers caused satisfaction	13.87	46	<.001	1.28	1.09	1.46
I felt relaxed during online marking	-2.65	46	.011	-0.45	-0.79	-0.11

Table 5 results revealed that faculty reported considerable stress in evaluating borderline instance ($p = .021$) and observed significant stress during online marking ($p = .011$). Mean scores trended descendant, although maintaining fairness and assigning partial marks were not statistically different from neutral. On the other hand, receiving well-written responses resulted in high levels of satisfaction ($p < .001$), which was a significant positive element that improved the marking experience in spite of common difficulties.

Phase-2

Thematic Analysis of Semi-Structured Interviews: Online Exam Marking Challenges

Participants: 15 faculty members from a university involved in online exam marking.

Data Collection: Semi-structured interviews with questions on challenges, mental effort, focus, and support in online exam marking.

Results of Phase-II

Phase of Analysis	Analytic Action	Data Evidence / Coding Outcome	Theme (Final)	Frequency (n = 15)	Illustrative Quote
Familiarization	Repeated reading of all interview transcripts to identify recurring patterns	Frequent references to strict marking rules, workload, fatigue, deadlines, and technology needs			
Initial Coding	Inductive line-by-line coding of meaningful segments	rigid key-based marking; limited conceptual judgment; duplication of work; administrative load; sustained focus; mental fatigue; AI support; tight deadlines			"Follow the key only, not concept."
Theme Development	Grouping conceptually related codes	rigid marking criteria	Rigid Marking Constraints	12	"I have to follow only the key."
		administrative workload; Google Sheets; duplicate data entry	Administrative & Technical Burden	10	"Extra sheets increase burden."
		concentration demand; high question volume; mental exhaustion	Cognitive Fatigue	9	"I must stay focused according to the key."
		AI tools; automation; digital assistance	Need for Digital Support	7	"AI tools could make marking easier."
		strict deadlines; inflexible timing; stress	Time Pressure & Flexibility	11	"Deadlines affect marking quality."

Phase of Analysis	Analytic Action	Data Evidence / Coding Outcome	Theme (Final)	Frequency (n = 15)	Illustrative Quote
Theme Review	Cross-checking themes against all transcripts for coherence and coverage	All themes appeared consistently across participants with no overlap or redundancy			
Final Reporting	Synthesizing themes into analytical findings	Procedural rigidity, administrative overload, cognitive strain, limited technology use, and time pressure collectively shape online exam marking experiences			

Merged Results

Faculty experienced significant mental and cognitive load during online exam marking, with over 70% reporting effortful, tiring, and attention-demanding tasks, particularly for long and higher-order questions. Administrative workload, time pressure, and strict deadlines further intensified fatigue and stress, while repetitive answers contributed to additional strain. Despite these challenges, markers expressed satisfaction with well-written student responses and highlighted the potential of digital tools and flexible schedules to ease marking and improve efficiency. Integration of both quantitative and qualitative data shows that cognitive load under online marking is not only statistically important but also experiential. The main issues are strict marking keys, duplication at the administrative level, lack of time and interface errors that transcend categories of CLT and make the life of the faculty harder. Organized student responses became one of the most important mitigating factors and reflected the importance of student preparedness in lessening marker load.

Conclusion

The results of the study revealed that grading exams online places a significant administrative, mental and cognitive strain on educators.

Fatigue and stress are caused by a number of factors, including high task complexity, repetitive work, tight deadlines, and demands for prolonged concentration. Although brief and well-written student responses satisfy professors, the entire marking process is quite difficult, underscoring the need for institutional solutions to lessen effort, promote focus and boost efficiency. There are a number of limitations of this study. Generalization can be impacted by the convenience sampling method and a small sample size. Self-reported data are subject to bias, and the single-institution focus limits cross-contextual applicability. The upcoming studies involving AI utilization and interface redesign should use longitudinal designs, multi-institutional samples, and experimental testing of AI interventions and interfaces redesigns.

Recommendations

1. Universities could use automated marking systems or AI-based grading assistants to cut down on boring work and accelerate data entry.
2. To reduce time pressure and enhance focus, give faculty more flexibility in marking times and stretch out deadlines.
3. To lessen cognitive fatigue, give fewer papers each day and offer scheduled pauses.
4. To increase faculty competency and confidence, provide training sessions on effective online marking techniques and resources.
5. Encourage Quality Responses: Encourage students to give concise, well-organized responses because this reduces marking effort and improves faculty satisfaction.

The future research ought to identify the longitudinal implications of cognitive load on grading accuracy, contrast load by subject area, and determine the effect of incorporating AI on faculty well-being and quality of assessment. There is also the need to research on the ways in which institutional training programs can be modified to minimize extraneous load and maximize germane processing.

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Citation of the Article: Yasmeen, R., Ahmed,M., & Naseer, S.(2026). Assessing the Cognitive Load of Faculty Members in Online Exam Marking at the Virtual University of Pakistan, *Journal of Educational Leadership and Management, 8(1), 29-42*