Increased Efficacy of Teacher Curated Lesson Materials in Learning Management System

Krishnendu Sarkar, NSHM Knowledge Campus, Kolkata, India

The Asian Conference on Education 2025
Official Conference Proceedings

Abstract

Reportedly, in the times of AI and disruptive technologies the sustained usage of faculty-made lesson materials by students were adversely being affected. Thereby, impairing the digital learning with Learning Management System (LMS), meant to enrich educational activities, especially in traditional spaces. To address a similar scenario in author's institution, a design for six sigma using DMADV methodology was initiated along with academic leadership team across various verticals of media, design, pharmacy, allied health, business & management, hospitality & tourism, and computing & analytics with a target to increase the effective usage of lesson materials from sub-optimal (below 25%) to above-optimal level (above 55%) within the period of 3 months of project implementation across the institution. The financial motivation of institution has been the maximization of return on investment on digital infrastructure, minimization of student backlogs and year lags that majorly would lead to dropouts. On the other, improvement in intake quality over the competition based on higher quality of learning outcomes. This paper elucidates the structured view of the project in form of a charter, voice of stakeholders, SIPOC, prioritization, CTQ specification table, sampling of students, faculty and alumni, root cause analysis, Kano modelling, statistical tests and validation of the new design by way of repurposing Bloom's Taxonomy with 10 human-human potential tracks of engagement, each mapped with higher-order thinking triplet verbs for best-fit lesson materials of value, negating rework and waste.

Keywords: lesson-material, real-time, value, design, DMADV

iafor
The International Academic Forum
www.iafor.org

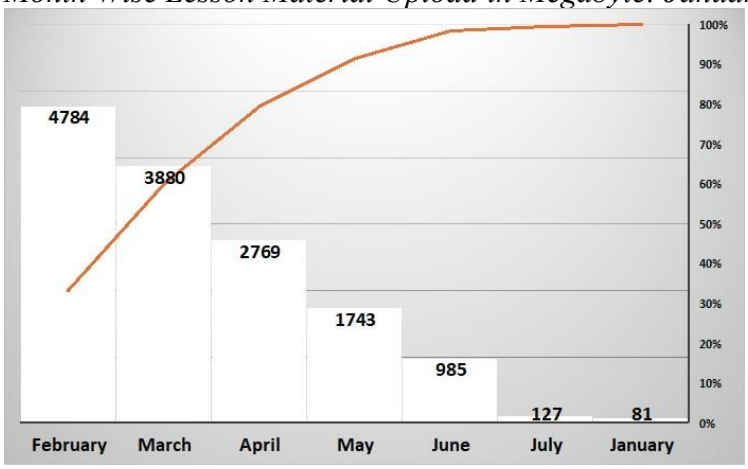
Background

From the data analysis of lesson materials uploaded on our institution's Learning Management System (LMS)[1] covering the even semester of 2025 (January – June) it was found that 6123 files, totaling nearly 15 Gigabyte,[2] additionally with 1045 links to internet resources were made available by 96 teachers, targeting 2548 undergraduate and 790 post graduate students. A Pareto analysis (Figure 1) in the above-mentioned period indicated that most of those materials were uploaded between February and mid-March (source: author, based on LMS data). Aside from that students were required to upload files as part of their continuous evaluation and other assigned tasks amounting not only to huge LMS information load but also raising concerns about its efficacy.

Yet, the information loading has been a routine compliance exercise without factoring students' receptibility of those materials. As a result, the teacher curated lesson materials in the era of Artificial Intelligence (AI) and disruptive digital technologies consistently showed a decline in sustaining the pull and engagement of students with LMS materials. It was a major roadblock for the LMS to transform from passive storage to active learning platform that would be dynamic, essential and optimal. In our consideration, sub-optimal use of lesson materials was anything less than 25% and above optimal, to begin with, was anything more than 55% for gradual elimination of rework and waste in form of unused or underused LMS materials by students.

Figure 1

Month-Wise Lesson Material Upload in Megabyte: January–June 2025



Source: Author

Literature

The Bloom's original *Taxonomy of Educational Objectives* work was revised (Anderson & Krathwohl, 2001) with emphasis on using action verbs for cognitive processes and categorizing types of knowledge, making it more practical for curriculum design, instruction, and assessment. Besides, to help educators more precisely with effective learning outcomes through effective teaching and assessment. Furthermore, how students could excel with real problem-injected learning compared to traditional instruction (Chiu, 2021), particularly when learning

[1] Digicampus (LMS) of NSHM Knowledge Campus Kolkata. India (author's institution).
[2] A Gigabyte is either 1 billion bytes in the decimal system or 1,073,741,824 bytes in the binary system, which equals 1024 Megabytes. In context, a Megabyte equals 1024 Kilobyte, and a Kilobyte equals 1024 bytes.

was meant to be inherently interesting and meaningful in satisfying the psychological needs of competence, autonomy and relatedness for academic success (Froiland, 2011).

The need, therefore, was clear. Teacher-curated lesson materials hosted on LMS must be attractive to students. In practice that was not, even when those materials were found to be instructionally robust and aligned with course outcomes (Bond, et al., 2020; Henderson, et.al, 2017). Because, students increasingly depended on external digital resources, peer-generated content, and AI-mediated summaries, frequently bypassing institutional learning materials (Selwyn, 2019; Zawacki-Richter, et al., 2019). A pattern that portrayed the necessity of instructional quality and accessibility with its sufficiency to establish the real-world usefulness of teacher-curated lesson materials as a value gain. Nevertheless, pedagogical frameworks[3] typically assumed that student's engagement would emerge once barriers were removed, instructional design was optimized, or learner activity got increased. However, what remained comparatively under-theorized was a more foundational question: why should students feel compelled to return to faculty lesson materials when alternative knowledge sources were readily available?

In response, the research instances involving dynamic synergies of teachers, students, and AI showed more adaptive, engaging, and personalised learning with honing of skills such as critical thinking, communication, collaboration, and creativity (Kwan, 2025). But there remained an issue with the verbs and repeat verbs for distinguishing the Bloom's cognitive levels in deployment of those verbs for teaching, learning and assessment (Stanny, 2016).

Introduction

In pursuit of project goal towards significantly improving the efficacy of LMS materials, the investigation using six sigma DMADV (Design, Measure, Analyse, Design, Verify) approach, proceeded with the understanding of the Voice of Customer (VOC) with a Google form survey using a discipline-wise randomized sample of our recent alumni batch. Thereafter, we conducted a focussed group discussion with sample participants over a Goggle meet. Because, as alumni, they had spent the entire student-life with the same LMS's lesson materials and, more so, were without any inhibition or bias after their graduation. The alumni respondents (n = 23) reported no daily use of materials on LMS to the question "*How often during your student days you referred to lesson materials*" and also did not strongly agree with the rest – "*Materials encouraged me to explore and discover more on the taught topics*", "*Materials were relevant and up-to-date*", "*Materials enhanced my knowledge and skills beyond classroom*" and "*Lesson materials on LMS complimented classroom teaching*".

Further, surveys involving a sample of our faculty, stratified based on their last annual appraisal reports, and students' sample, stratified based on their academic grades and disciplines, were conducted using blind, hand-filled questionnaires that ensured respondent diversity, unbiasedness, and anonymity. The survey had Likert-scale, Binary (Yes/No) questions, Categorical and Open-text items. Data were processed from faculty (n = 30) and students (n = 87) responses, enabling both quantitative and qualitative analyses based on questions under sections, namely, *Usage patterns*, *Perceived value*, *Access & usability*, *Communication & engagement* meant for Students and on the other, *Practices*, *Communication with students*, *Quality & resources*, *Challenges* meant for Faculty. Put together, the VOC of alumni, faculty

[3] Provides guidance on evidenced-based strategies and practices supporting an integrated approach for quality teaching aligning curriculum, assessment and pedagogy.

and students indicated low motivation and low expectation about LMS's lesson materials and fuelled the felt need to increase the efficacy of teacher-curated materials.

Given the above, our DMADV project charter focussed on creating a design for plausible solution using Design for Six Sigma (DFSS) methodology (Brue & Launsby, 2003) that can assure increased engagement and satisfaction of students by organically engaging teachers, students, and responsible AI for reclaiming pedagogical prowess in physical spaces without resisting technologies. Moreover, correct the uncontrolled content abundance in LMS and create immediate relevance thereby motivating students to primarily use the faculty-curated resources injected with Real Time Value (RTV) as a design response to the project goal.

Following that, a SIPOC (Suppliers, Inputs, Process, Outputs, Customers) was tabled (Table 1a) with Critical to Quality (CTQ) Specification (Table 1b) based on XY (cause and effect) prioritization matrix, which prioritized process inputs (Xs) based on their impact on customer-critical outputs (Ys), paving the way for positioning the RTV.

Table 1a
SIPOC

SIPOC	
Supplier	Course instructors, LMS administrators, Academic administration, Generative AI, In-house IT support team and Library
Input	Templates for lesson plan and lesson materials, LMS user manual/guides, LMS system, user-interface, Student enrolment data, Faculty data, Faculty-tagged courses, curriculum, attendance, cohorts, routines, system access credentials
Process	▪ Faculty Development Program ▪ Preparation of lesson materials ▪ Upload of materials on LMS ▪ Student access and download ▪ Communication booths for department-wise teachers' group, students' group ▪ AI-assisted real-world applications connect with materials and tasks/assignments, class interactions, group-presentations and multi-mode assessments ▪ Continuous Quality Improvement (Task-design, Teaching, Assessment, Lesson materials, Learning outcomes)
Output	Lesson Material Uploads, Questions/Tasks, Students' task submissions, LMS Usage logs, Survey feedback, Material diversity, RTV Class interaction/presentation, Grades
Customer	Students (primary target). Others (secondary) –Faculty, Internal Quality Assurance Cell, Accreditation bodies, Regulatory, Rating/Ranking agencies, Employers, Parents

Table 1b
CTQ Specification

CTQ Specification Table			
Student Need	CTQs (Students' Batch)	Measurement	Defect Definition
Relevant and Interesting Lesson Material with real-world application triggers	Curated Lesson Material available on LMS	Release status	> 3 days of start of course teaching
	Course articulation available on LMS	Course Outcome (CO)-Program Outcome (PO) mapping, CO-Bloom level mapping, Evaluation rubric	Unavailability
	Faculty expertise	Qualification, Experience, Fulfilment level	Unavailability
	Faculty teaching load	Average teaching hours/ week	> 20
	Faculty Industry awareness and trends	Average faculty hours spent in Industry or Industry relations (visits/collaborations)/ Semester	< 10
Joyful learning and practical engagement with tasks and materials	Problem/Project-based learning support	Average number of Batch-wise RTV assignments/ Semester	< 3
	Beyond classroom	Average student hours used in outdoor study, survey, project, internships etc./ Semester	< 30

Positioning of RTV

Even though, Universal Design for Learning (UDL) had substantial contributions by foregrounding equity and inclusion through multiple means of representation, engagement, and expression (CAST, 2018; Meyer, et.al, 2014), still reviews of UDL research indicated something concerning. That while such frameworks effectively reduced participation barriers, it offered limited guidance on how learners perceive the immediate value or necessity of learning materials once access is ensured (Al-Azawei, et.al., 2016; Rao, et.al, 2014). In that sense, UDL reportedly fell short of ensuring situationally meaningful engagement.

In the study of instructional design models such as Analysis, Design, Development, Implementation, Evaluation (ADDIE) and Technological Pedagogical Content Knowledge (TPACK) the emphasis was found on systematic alignment among content, pedagogy, and technology (Branch, 2009; Mishra & Koehler, 2006). Thereby, strengthening instructional coherence and teacher competence. Whereas learners, at the best, were meant to be recipients of optimized instruction. Arguably, therefore, even well-designed LMS materials were often underused in practice without definitive answers to reverse the trend. Additionally, from the study of another set of literature on design thinking approaches in education, which promoted creativity and problem solving through iterative innovation (Henriksen, et.al, 2017; Razzouk & Shute, 2012), it was apparent that the applications were through episodic or project-based interventions where the injection of real-time value inside taught lessons and materials were not mandated by design. Nevertheless, active learning and student-centred pedagogies were supported by strong empirical evidence in improving learning outcomes (Freeman, et.al., 2014; Prince, 2004).

However, it did not guarantee meaningful engagement or conceptual anchoring, particularly when activities were weakly integrated with coherent instructional narratives (Kirschner, et.al, 2006). So, lesson materials often remained optional supplements for teaching rather than indispensable learning resources.

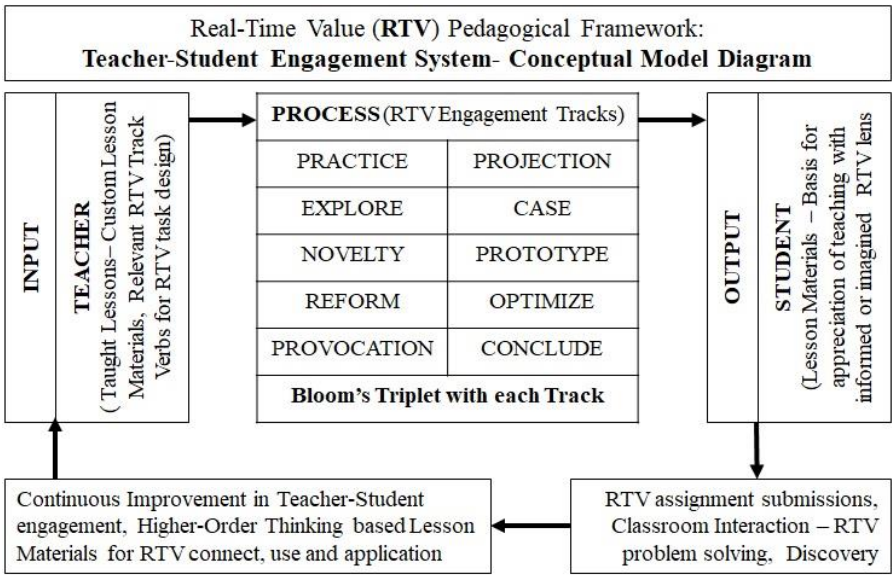
Gap Bridging

Conclusively, the research gap that emerged was the absence of a design logic that explicitly targets perceived real value of taught lessons and materials. Because, existing frameworks or models only prioritized access, alignment, participation, or creativity, but rarely addressed how learning materials can be designed to create immediate relevance and dependency during real problem encounters. Thus, RTV attempted to bridge that gap, by introducing, a value-first, design-led pedagogical construct. Here adding activities or enhancing access with superior user interfaces for user experience's sake was not the issue. Rather, RTV was a design to embed real-time relevant triggers within lesson materials for intentionally creating conditions under which students would be required to consult teacher-curated materials on LMS.

In doing so, RTV aimed to reposition lesson materials from passive to resources of "Must-be" necessity targeting the "Attractive–Performance" domain of the Kano model of quality and satisfaction[4] (Kano et al., 1984; Matzler & Hinterhuber, 1998). That way providing a strong basis to interestingly alter the traditional teacher-student engagement behaviour. Hence, RTV was not to be positioned as a conceptual proposition alone, but as a novel pedagogical framework (Figure 2) for rigorous and continuous application and evaluation by way of a self-organized human-human engagement system involving student tasks and teacher materials.

Figure 2

Real-Time Value (RTV) Pedagogical Framework



Source: Author

Subsequently, the RTV idea-acceptance was ascertained through survey polls conducted on LMS, which was open to all faculty and students' having private access credentials. The

[4] Quality and satisfaction (Kano model) characterized by a predictable evolution from a "delighter/attractive" (unexpected, high satisfaction) to a "performance" feature (desired) and finally to a "must-be" feature (expected, baseline) as customer expectations change over time.

analyses showed positive acceptability, though with some manageable concerns, as indicated in the summary report (Table 2). Going forward, RTV was to be tried and tested as a value injection inside lesson materials curated for RTV tasks, piloted with first semester students.

Table 2
Initial RTV Idea-Acceptance by Teachers and Students: *Survey Summary*

Faculty (n = 58)	**Students (n = 461)**
Overall faculty mean score (per respondent): 1.65 (on 0–3 scale where ~2+ is positive) RTV as a design ~71% positive. RTV with AI ~73% positive. Early Response Positive: majority leaning. **Interpretation**: Strong initial interest. Most faculty were found to be positively inclined toward RTV as a design and supportive of integrating AI where applicable, though there were neutral and concerned voices asking for RTV training workshop and more clarification.	Overall mean score (per respondent): 1.46 (more neutral to leaning positive). Early RTV ~71% positive. Early RTV experience ~ 67% positive. RTV initial use ~51% positive (many reported Low or Not at All). **Interpretation**: Students found the idea interesting, but current use of RTV-like tasks was limited. About half reported high present use while measurable portions reported low or no use. They were curious but expected scaffolding.

Methodology

To operationalize the perceived real-time value using RTV, a Design Science Research (DSR) paradigm was used to create a novel solution that was to be made defect-free and robust with DFSS (Hevner, et.al., 2004; Peffers, et.al., 2007). In this regard, both DSR and DFSS were considered integral to the design for delivering practical and optimized solution to address real-problem tasks with lesson materials. The DFSS (DMADV) methodological structure was finalized based on the previous analyses of student and faculty perceptions and research gap bridging that resulted in the identification of vital few CTQs (Table 3a & 3b) for proceeding with the RTV, as a mechanism for increased effectiveness of lesson material and its verification. Consequently, the RTV tracks with a triplet of engagement verbs against each track was laid out (Figure 3) for task allocation and material curation.

Table 3a
Vital CTQs in DFSS (DMADV) Design: Efficacy

Lesson Material Quality – Root CTQs	**Lesson Material Design**	**Effectiveness**
CTQ-1: Must support a RTV track with relevant taught material concepts	**Static**: Concept mapping diagram of entire course lessons (*common for one taught subject in a Semester*) **Dynamic**: RTV updated materials on LMS from time to time, Practice triggers, Linkages to internet resources and relatable examples.	Lesson material is effective if assignments truly show moderate-to-high use of RTV instances with expected outputs, well-attended RTV class interactions, Grand-RTV high-quality outputs, Attendance is by pull and not push, Value over volume is high (feedback)
CTQ-2: Must allow multi-track assignment creation and multi-mode tests		
CTQ-3: Must allow students to discover new materials both related (disciplinary) and related (inter-disciplinary)		
CTQ-4: Must allow evidence of outputs in sync with Course and Program outcomes		

Table 3b
Vital CTQs in DFSS (DMADV) Design: Verification

	Verification (Batch-wise, Semester-wise)
CTQ-1	Number of Training Programs/ Sessions on RTV attended by faculty > 2, Induction program on RTV for new faculty > 1, Slippages < 10% of faculty lesson materials were without any assigned engagement with RTV track
CTQ-2	RTV multi-mode assignments/tests conducted > 2, Slippages from teachers < 5%, Slippages from students < 10%
CTQ-3	Number of additional materials, reportedly used and verified, outside LMS Lesson Materials (RTV and Grand-RTV submissions) > 5, Slippage < 25 % of students
CTQ-4	Teacher materials with RTV > 75%, Valid RTV task submission by students > 70 %, Valid Grand-RTV submitted by groups > 90%, Course Outcomes covered > 80 %, Average increase in Cumulative Grade Point Average (CGPA) > 7 % (for students with previous CGPA > 6.5)

Figure 3
RTV Track based Teacher-Student Engagement Design

TEACHER		**STUDENT**
# **RTV Track**	**Engagement-Demand Verbs**	**Lesson Materials Efficacy (Measure)** (*single subject or combination of taught subjects*)
1. PRACTICE	Modify, Change, Improve	Active participation in class/Lab/field/home work and assessments based on assigned real value problems
2. EXPLORE	Assess, Appraise, Agree	Motivation for discovery of several resources in and around the given materials on topics of interest
3. NOVELTY	Originate, Create, Build	Learnt foundational knowledge and skills used for innovative pursuits and demonstrations
4. REFORM	Compare, Construct, Elaborate	Study of multiple lesson points and reconstruction of perspectives, especially with interest groups
5. PROVOCATION	Suppose, Propose, Predict	Ideas based on factual basis of materials serving as stepping stone for envisioning possibilities.
6. PROJECTION	Examine, Evaluate, Explain	Use in anticipated problem opportunity and solution
7. CASE	Take part, Survey, Test	Mapping of relevant situation for analyses and inference
8. PROTOTYPE	Design, Develop, Discuss	Model conceptualisation, preparation, presentation
9. OPTIMIZE	Estimate, Measure, Determine	Ability to quantify, compare, best-compromise, decide
10. CONCLUDE	Judge, Justify, Recommend	Relevant citations outside lesson materials supporting the RTV submissions (subject-RTV and Grand – RTV).

Source: Author and Bloom's Taxonomy

DSR-DFSS (DMADV) Integration

To reiterate, RTV design involved DSR and DFSS integration.[5] Specifically, the "Artifact Design and Development" stage of DSR was executed within the "Define" and "Measure" phases of DFSS(DMADV). The "Evaluation" component of DSR was synthesized with the "Analyse" and "Design" phases of DFSS(DMADV) to refine the solution. Finally, DSR-driven validation, conducted through testing and confirmation, was mapped to the "Verify" phase of DFSS to ensuring vital CTQs of the RTV were met by working with the shared objectives of DSR-DFSS integration under the project goal. Those were – a) Reposition lesson materials from passive references to resources of necessity, b) Embed engagement demands in lessons/tasks that necessitated consultation of faculty materials, c) Support higher order thinking without increasing cognitive overload, and d) Ensure applicability within and across disciplines and teaching contexts.

Table 4
RTV As Design Artifact (DSR) With DFSS Integration

Artifact Type	DSR Phase Actions	Problem identification	DFSS (VOC/VOF: LMS[2] materials underutilized)
CONSTRUCT	RTV as a design concept	Objectives	Lesson materials necessary for RTV task
MODEL	Teacher–Student engagement system	Design & development	RTV framework with distinct tracks for lesson material curation and use
METHOD	RTV task-design logic using Bloom triplets	Demonstration	Classroom RTV interactions and Grand-RTV group-presentations using lesson materials
FRAMEWORK	RTV tracks aligned to Kano (Basic, Delighter, Satisfier)	Evaluation	Surveys, Kano analysis, Beneficiary VOC/VOF
INSTANTIATION	RTV and Grand-RTV	Communication	*Student outputs:* Poster, Report, Article, Presentation, Posts, etc.

A Three-Tier Engagement

Tier 1- Cognitive Activation (Verbs). The verbs selected became the cognitive demand.
Tier 2- RTV Relatable Instance (Real-time local-global problem, Human-AI curated). The real-time problem became the context.
Tier 3- Lesson Material on LMS. It became the knowledge resource for accomplishing the assigned RTV task

The triangulation of the above tiers assured that RTV and Grand-RTV, a flip-learning[6] activity, were value-first (Figure 4), backed by Kano-informed educational value classification and engagement logic.

[5] In integration context, DSR delved on the "how" of RTV designing while DFSS focused on the "what "of measurement and control.
[6] Through group work, debates, labs, fieldwork, and real problem-solving with teacher support.

Figure 4

RTV and Grand-RTV Tasking of Students for Curation of Lesson Materials

RTV	**Grand RTV**
Mid-term	End-of-Teaching
Subject-wise	All subjects combined
Do-it-Yourself	Group-based (flip-learning activity)
On/Off-campus activity	On-campus activity
Common Objectives	
Use of AI for generating relatable RTV instances (in and around taught topics)	
RTV Track(s) based task design with the engagement-demand verbs (Fig.3)	
Lesson Materials made available and discussed for the assigned RTV tasks	
Task submission (*with or without use of AI declaration*) and evaluation -- presentation, viva voce, class interaction, peer learning, outputs, feedback	
Continuous quality improvement in -- pen-on-paper examinations, participative and interactive teaching & learning, other course and program outcomes	

Source: Author

Findings

Our early findings were based on RTV subject-wise assignment, evaluation, material submissions on LMS, teacher moderated class interactions around those submissions, and feedback. From that it was fair to conclude that RTV aligned well with the constructivist and situated learning perspectives, which corroborated that learning value emerged most strongly when knowledge was activated within authentic or anticipatory contexts (Brown, et.al., 1989; Jonassen, 1999). Particularly, when challenged to reinterpret, reformulate, or apply concepts (Vosniadou, 2008). Subsequently, a reference template (Table 5) for Grand-RTV task design was made available using an ideal distribution of subject-wise representation in Grand-RTV's group-wise task-design for conducive material preparation and use by each of the groups. Finally, RTV design, as a response to the project goal, were mapped in alignment with Kano zones (Table 6), which captured the fitment of RTV tracks thereto.

Table 5

Distribution of Subject Topics in Grand RTV Group-Tasking: Reference Template

Batch *xyz* **Semester #**	% age distribution of taught topics of subjects for Grand RTV task generation using AI (*an example using 6 core-subjects and 6 groups/ Batch, Group size 3–10 students*)						**Total**
	Group (a)	Group (b)	Group (c)	Group (d)	Group (e)	Group (f)	
Subject 1	25	15	15	15	15	15	100
Subject 2	15	25	15	15	15	15	100
Subject 3	15	15	25	15	15	15	100
Subject 4	15	15	15	25	15	15	100
Subject 5	15	15	15	15	25	15	100
Subject 6	15	15	15	15	15	25	100
Total	100	100	100	100	100	100	

Table 6
RTV-Kano Modelling

RTV Track	Kano Zone	Research Basis	Justification	Insight
PRACTICE	**Emerging Attractive**	Deliberate practice theory (Ericsson, 2008). Formative feedback loops (Hattie & Timperley, 2007).	Students perceived immediate usefulness when lesson materials became necessary for task refinement	Converted static content from Indifferent to Performance (Kano zones).
EXPLORE	**Attractive**	Peer calibration and judgment (Nicol & Macfarlane-Dick, 2006). Metacognition and self-regulated learning (Zimmerman, 2002).	Students considered lesson materials as stepping stones for real world understanding and exploration	Students not only read but also experienced the faculty materials
NOVELTY	**Attractive**	Constructivist knowledge creation (Jonassen, 1999). Creativity in learning (Kaufman & Beghetto, 2014).	Students exhibited learning delight (Kano delighter)	Students accepted RTV as differently engaging with self-urge for next
REFORM	**Emerging Performance**	Dialogic teaching (Alexander, 2017). Conceptual change theory (Vosniadou, 2008).	Intentionally, students reconstructed their prior understanding from lesson materials	Created "must-consult" necessity for lesson materials
PROVOCATION	**Attractive (High)**	Inquiry-based learning (Hmelo-Silver, et al., 2007). Epistemic curiosity (Loewenstein, 1994).	Activated curiosity gaps that was only to be resolved with the help of teacher(s) and materials	Students felt intellectual "pull" not "push" (Kano delighter- High)
PROJECTION	**Attractive**	Situated cognition (Brown, et.al, 1989). Transfer of learning (Perkins, Salomon, 1992).	Moved knowledge into the related and anticipated uses	Students began perceiving lesson materials as tools, not mere notes
CASE	**Emerging Attractive**	Case-based reasoning (Kolodner, 1997). Experiential learning cycle (Kolb, 1984).	Anchored theory to realism, increasing performance needs - linear satisfiers[7]	Strong stabilizer track-- prevented RTV becoming overly abstract
PROTOTYPE	**Emerging Performance**	Learning by making (Papert, 1980). Design-based learning (DBL literature).	Materialized learning and demanded deep reference to faculty materials	Delivered majorly through Grand RTV submissions
OPTIMIZE	**Performance**	Quantitative reasoning in learning (Shavelson, 2008). Decision-based learning (Plummer, et.al., 2017).	Reinforced analytical rigor and decision-making capacity	Evident in STEM[8] and applied fields based RTV submissions
CONCLUDE	**Emerging Must-Be**	Argumentation theory (Toulmin, 1958). Critical thinking frameworks (Facione, 2011).	Demanded synthesis, evidence, and defensible judgment	Transitioned to "Must-Be" (Kano), especially, with Grand RTV

[7] linear satisfiers are service or product characteristics that generate satisfaction when fulfilled and dissatisfaction when not fulfilled.
[8] Science, Technology, Engineering, and Mathematics (STEM) education focused on real-world problem-solving, critical thinking, and innovation.

Conclusion

Our project provided a rigorous and transparent structure for the design, optimization, and validation of the RTV design framework in structuring how learning experiences can be intentionally created and sustained with Bloom's taxonomy that is used as a design grammar, ensuring internal coherence between tasking of students and lesson materials. However, our validation was at the best indicative as the DMADV's Verify phase was undergoing during the time of writing this paper. Further, naturally occurring educational variability over a prolonged period was required to be observed against our reported early findings.

Anyways, it can be reasonably concluded that our project demonstrated how a minimum viable RTV design can created using quality engineering principles like six sigma that can be used to make academics more relevant in the times of AI. Here it can be claimed that RTV design was successful in navigating the Kano transition from a purely "Attractive/Delighter" attribute to a "Performance" attribute. Because the RTV's brought coherence in taught lesson, lesson material and assessment quality that surfaced as a primary driver of student satisfaction. Supported by harmonious faculty scaffolding, the RTV is poised to building the reliability necessary to eventually be classified as a "Must-be" requirement, where its absence would be viewed as a critical failure in meeting teacher-student engagement needs. That is for the far later with extremely strong and sustained faculty scaffolding adaptive to students' demand on their choice of RTV track, their combination of tracks, their time, and at their desired level of task-difficulty.

Meanwhile, from the findings, two RTV tracks, *Provocation* and *Conclude* used in loop, would be highly recommended as a combination for university students of any discipline interested with thinking-based innovative deliverables. Aside from that, certain spinoffs would be like – reduced teaching load, leaner information-load and waste-mitigation, effective self-learning and discovery, and importantly, saved teaching-hours deployed productively for mentorship, faculty development, and research. Indeed, such realities and possibilities with RTV should excite students, researchers, educators and other stakeholders of higher education.

Acknowledgements

The author would like to acknowledge Indian Statistical Institute, Mumbai for six sigma materials and assistance. Additionaly, NSHM Knowledge Campus Kolkata for involving project participants across multiple academic portals of Computing & Analytics, Health Science, Pharmacy, Business & Management, Media, Design, and Hospitality.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

No use: The author declares that no AI-assisted software like Grammarly was used to refine or correct the content in the manuscript or for generation of figures and tables of manuscript.
Use: The usage of AI assistance from ChatGPT and Gemini ai were limited to insights on the RTV design distinctiveness, similar working cases in comparison, and for mock-practice with generation of real time instances for RTV and Grand-RTV based on select set of taught topics, as part of the project requirements.

References

Al-Azawei, A., Serenelli, F., & Lundqvist, K. (2016). Universal Design for Learning (UDL): A content analysis of peer-reviewed journal papers from 2012 to 2015. *Journal of the Scholarship of Teaching and Learning, 16*(3), 39–56. https://doi.org/10.14434/josotl.v16i3.19295

Alexander, R. J. (2017). *Towards dialogic teaching: Rethinking classroom talk* (5th ed.). Dialogos.

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.

Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic evidence map. *International Journal of Educational Technology in Higher Education, 17*(1), 1–30. https://doi.org/10.1186/s41239-019-0176-8

Branch, R. M. (2009). *Instructional design: The ADDIE approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32–42. https://doi.org/10.3102/0013189X018001032

Brue, G., & Launsby, R. (2003). *Design for Six Sigma*. McGraw-Hill.

CAST. (2018). *Universal Design for Learning guidelines version 2.2*. https://udlguidelines.cast.org

Chiu, T. K. F. (2021). Student perceptions of academic engagement and student–teacher relationships in problem-based learning. *Frontiers in Psychology, 12*, 713057. https://doi.org/10.3389/fpsyg.2021.713057

Ericsson, K. A. (2008). Deliberate practice and the acquisition and maintenance of expert performance: A general overview. *Academic Emergency Medicine, 15*(11), 988–994. https://doi.org/10.1111/j.1553-2712.2008.00227.x

Facione, P. A. (2011). *Critical thinking: What it is and why it counts* (Research report). The California Academic Press.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America, 111*(23), 8410–8415. https://doi.org/10.1073/pnas.1319030111

Froiland, J. M. (2011). Intrinsic motivation to learn: The nexus between psychological health and academic success. *Contemporary School Psychology, 15*(1), 91–100. https://doi.org/10.1007/BF03340978

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81–112. https://doi.org/10.3102/003465430298487

Henderson, M., Selwyn, N., & Aston, R. (2017). What works and why? Student perceptions of "useful" digital technology. *Studies in Higher Education, 42*(8), 1567–1579. https://doi.org/10.1080/03075079.2015.1007946

Henriksen, D., Richardson, C., & Mehta, R. (2017). Design thinking: A creative approach to educational problems. *Educational Technology, 57*(3), 5–11.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly, 28*(1), 75–105. https://doi.org/10.2307/25148625

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and Achievement in Problem-Based and Inquiry Learning: A Response to Kirschner, Sweller, and Clark. *Educational Psychologist, 42*(2), 99–107. https://doi.org/10.1080/00461520701263368

Jonassen, D. H. (1999). *Designing constructivist learning environments*. Lawrence Erlbaum.

Kano, N., Seraku, N., Takahashi, F., & Tsuji, S. (1984). Attractive quality and must-be quality. *Journal of the Japanese Society for Quality Control, 14*(2), 39–48. https://doi.org/10.20641/jjsqc.14.39

Kaufman, J. C., & Beghetto, R. A. (2014). Creativity in the schools: Renewed interest and promising new directions. In M. J. Furlong, R. Gilman, & E. S. Huebner (Eds.), *Handbook of positive psychology in schools* (2nd ed., pp. 165–175). Routledge/Taylor & Francis Group.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, *41*(2), 75–86. https://doi.org/10.1207/s15326985ep4102_1

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.

Kolodner, J. L. (1997). Educational implications of analogy: A view from case-based reasoning. *American Psychologist*, *52*(1), 57–66. https://doi.org/10.1037/0003-066X.52.1.57

Kwan, P., Ng, D. T. K., Chu, S. K. W., Leung, J. K. L., & Chiu, T. K. F. (2025). Reimagining flipped learning via Bloom's taxonomy and student–teacher–GenAI interactions. *Education Sciences*, *15*(4), Article 341. https://doi.org/10.3390/educsci15040341

Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin*, *116*(1), 75–98. https://doi.org/10.1037/0033-2909.116.1.75

Matzler, K., & Hinterhuber, H. H. (1998). How to make product development projects more successful by integrating Kano's model. *Technovation*, *18*(1), 25–38. https://doi.org/10.1016/S0166-4972(97)00072-2

Meyer, A., Rose, D.H. & Gordon, D. (2014). *Universal Design for Learning: Theory and practice*. CAST.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017–1028. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education*, *31*(2), 199–218. https://doi.org/10.1080/03075070600572090

Papert, S. (1980). *Mindstorms: Children, Computers, and Powerful Ideas*. Basic Books.

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of Management Information Systems*, *24*(3), 45–77. https://doi.org/10.2753/MIS0742-1222240302

Perkins, D. N., & Salomon, G. (1992). Transfer of learning. In T. Husén & T. N. Postlethwaite (Eds.), *The international encyclopedia of education* (2nd ed., pp. 425–441). Pergamon.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, *93*(3), 223–231. https://doi.org/10.1002/j.2168-9830.2004.tb00809.x

Plummer, K., Swan, R., & Lush, N. (2017, March 6–8). Introduction to decision-based learning. In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.), *INTED2017 proceedings: 11th International Technology, Education and Development Conference* (pp. 5954–5959). IATED Academy. https://doi.org/10.21125/inted.2017.1388

Rao, K., Ok, M. W., & Bryant, B. R. (2014). A review of research on universal design for learning in higher education. *Journal of Postsecondary Education and Disability*, *27*(1), 41–56. https://www.ahead.org/professional-resources/publications/jped/archived-jped/jped-volume-27

Razzouk, R., & Shute, V. (2012). What is design thinking? An overview of its characteristics, processes, and challenges. *Educational Technology*, *52*(3), 13–22.

Selwyn, N. (2019). *Should robots replace teachers?* Polity Press.

Shavelson, R. J. (2008). Reflections on quantitative reasoning: An assessment perspective. In B. L. Madison, L. A. Steen, & D. G. Smith (Eds.), *Calculating changes: The challenges of quantitative literacy* (pp. 15–41). Association of American Colleges and Universities.

Stanny, C. J. (2016). Reevaluating Bloom's taxonomy: What measurable verbs can and cannot say about student learning. *Education Sciences*, *6*(4), Article 37. https://doi.org/10.3390/educsci6040037

Toulmin, S. E. (1958). *The uses of argument*. Cambridge University Press.

Vosniadou, S. (Ed.). (2008). *International handbook of research on conceptual change*. Routledge.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – Where are the educators? *International Journal of Educational Technology in Higher Education, 16*(39). https://doi.org/10.1186/s41239-019-0171-0

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice, 41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2

Contact email: krishnendu.sarkar@nshm.com