

Slidesmaxxing : Does gamification of lectures increase student engagement? Evidence from an MSc Analytics Cohort

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ABSTRACT

This paper presents findings from a mixed methods, within subject crossover study conducted across two consecutive academic terms (2025/26) at Ravensbourne University London, investigating whether gamified, minimal text, UX style interactive web applications produce measurably superior student engagement and knowledge retention compared with conventional text heavy slide decks in undergraduate and postgraduate analytics teaching. Two purpose built interactive tools, DataStream Academy (cbushellanalytics.base44.app) and SEOMastery (cbushellseo.base44.app), were deployed across six teaching sessions with a combined sample of 63 students enrolled in the MSc Digital Channels and Analytics programme. Data were collected through immediate and delayed post session knowledge assessments, the validated Leppink et al. (2013) cognitive load instrument, real time interaction logs, live audience polling, and semi structured post session interviews. Students in the interactive condition scored significantly higher on immediate retention assessments ($M = 72.4\%$ vs. $M = 58.1\%$; $t(62) = 6.83$, $p < .001$, $d = 0.86$) and reported markedly lower extraneous cognitive load. Interaction log analysis identified response latency as the strongest single predictor of knowledge outcomes ($r = -.61$, $p < .001$). Thematic analysis of interview data revealed four salient engagement mechanisms: active data agency, immediate feedback salience, competitive motivation, and reduced visual noise. Findings support the theoretical predictions of Sweller's (1988) Cognitive Load Theory and Mayer and Moreno's (2003) Cognitive Theory of Multimedia Learning, and contribute a contextualised empirical account to the emerging literature on gamification in specialist higher education.

1. INTRODUCTION

The internet has given rise to a loose but widely recognised vocabulary of self optimisation. On social media platforms, particularly TikTok and YouTube, the suffix maxxing has come to denote the practice of maximising a particular attribute or behaviour to its logical extreme. The most prominent current example is looksmaxxing, broadly understood as the obsessive pursuit of physical attractiveness through whatever means available (Schilling, 2026). The influencer most associated with bringing looksmaxxing into mainstream awareness is the American streamer known online as Clavicular, described by Schilling (2026) in The Guardian as one of the most prominent influencers in the

looksmaxxing community. Beyond looksmaxxing, the maxx suffix has spread into adjacent areas of self improvement, including sleepmaxxing and brainmaxxing, and is now recognised as a broader cultural shorthand for deliberate, effortful maximisation of a given domain. The present paper borrows this framing deliberately. Slidemaxxing, as used here, refers to the practice of maximising the interactive, visual, and participatory qualities of a teaching presentation, stripping away passive text heavy content in favour of live tools, embedded tasks, and real time feedback. The central concern of this paper is student engagement, by which we mean, following Chaffey (2019), the active interaction and participation of an audience with content or experience, with the aim of achieving a measurable outcome. Applied to the classroom, this encompasses students who are not merely present but who are responding, questioning, and demonstrating visible understanding in real time. The question this paper asks is a simple one: does slidemaxxing increase that?

There is a productive irony at the heart of contemporary analytics teaching: the discipline demands that practitioners read data critically, interrogate visualisations, and draw meaning from complex information environments, yet it is routinely taught through a medium that exemplifies precisely the failure modes it seeks to address. The text heavy lecture slide, crowded with bullet points and explanatory prose, represents an instructional design approach that cognitive science has comprehensively problematised over four decades of research (Sweller, 1988; Chandler and Sweller, 1992; Mayer and Moreno, 2003). Students asked to process dense on screen text whilst simultaneously listening to a lecturer narrate the same content are not being helped; they are being subjected to what Sweller (1988) termed extraneous cognitive load, effort consumed by the instructional format itself rather than by the learning objective.

The study emerged from a practical classroom observation. Teaching web analytics and search engine optimisation (SEO) to postgraduate students on the MSc Digital Channels and Analytics programme at Ravensbourne University London, the author noticed a recurring pattern: in sessions delivered through conventional text heavy slides, student attention appeared to drop noticeably from around the twenty minute mark, quiz responses tended to be shallow and closely tied to what had appeared on screen rather than demonstrating understanding, and students frequently reported uncertainty about how to apply concepts to new data scenarios. This type of passive engagement is well documented in the literature on lecture based technical teaching (Szabo and Hastings, 2000; Shatri, 2022).

The intervention under investigation replaces conventional slide based delivery with two purpose built interactive web applications: DataStream Academy (cbushellanalytics.base44.app), designed for live web analytics exploration, and SEOMastery (cbushellseo.base44.app), developed for interactive SEO concept teaching. Both tools embody three design principles derived from the cognitive science literature: minimal on screen text, progressive disclosure of complexity, and real time feedback on student interaction. They constitute, in Deterding et al.'s (2011, p. 10) terms, an application of 'game design elements in non game contexts', incorporating challenge, immediate feedback, and interaction driven progress, the core affordances identified by Hamari, Koivisto and Sarsa (2014) as mediating the relationship between gamification and learner engagement.

The study's contribution is threefold. First, it provides empirical evidence from a specialist higher education context, creative and digital industries, that has been underrepresented in cognitive load and gamification research, the majority of which derives from STEM and language learning settings (Hamari, Koivisto and Sarsa, 2014). Second, it introduces the concept of interaction log analysis as a diagnostic pedagogical tool: the study demonstrates that behavioural signals captured by interactive presentation tools can predict

knowledge outcomes with meaningful accuracy. Third, it contributes methodological specificity to an area where, as Berdousis (2024) observed, the relationship between gamification and deep academic achievement has remained under evidenced.

2. LITERATURE REVIEW

2.1 Cognitive Load Theory and the Instructional Design of Slide-Based Teaching

Sweller's (1988) Cognitive Load Theory (CLT) proposed that human working memory is fundamentally limited and that instructional design that fails to accommodate this limitation will impede learning regardless of the quality of the underlying content. Sweller (1988) distinguished between intrinsic cognitive load, the irreducible difficulty of the subject matter, and extraneous cognitive load, generated by suboptimal instructional design and directly reducible through improved presentation choices. A third component, germane cognitive load, was later articulated by Sweller, Van Merriënboer and Paas (1998) to describe the productive mental effort that constructs lasting knowledge schemas; crucially, extraneous and germane load are competitive: unnecessary design complexity crowds out the cognitive space required for genuine learning.

Chandler and Sweller (1992) provided early empirical instantiation of these principles in their studies of technical instruction, demonstrating that forcing learners to integrate spatially separated text and diagrams, the split attention effect, imposed measurable performance costs relative to integrated formats, even when all information was formally available in both conditions. This finding has direct implications for the analytics lecture slide, which routinely places explanatory text alongside data visualisations in precisely the separated configuration that Chandler and Sweller (1992) identified as cognitively costly.

The redundancy effect, documented by Mayer and Moreno (2003), provides a second mechanism through which conventional slide design impedes learning. When identical information is presented simultaneously in two verbal modes, the lecturer speaking the content whilst students read it from the screen, the verbal processing channel is overloaded with redundant input rather than freed to receive complementary narration. Mayer and Moreno (2003, p. 45) demonstrated that 'people learn more deeply from graphics and narration than from graphics, narration, and on screen text', a finding replicated across numerous subsequent studies and directly at odds with the standard design of most academic lecture slides.

The practical implication for analytics education is significant. Web analytics and SEO teaching, as practised at Ravensbourne, involves visualisations of high intrinsic complexity, traffic distributions, funnel analyses, keyword landscapes, that place substantial intrinsic load on students encountering them for the first time. Embedding dense explanatory text in the same visual field as these data representations compounds the load with avoidable extraneous components. CLT prescribes the opposite: strip the slide of text, deliver explanation verbally, and allow the full capacity of working memory to engage with the data itself.

2.2 Gamification and Learner Engagement in Higher Education

Deterding, Dixon, Khaled and Nacke (2011) provided the definitional foundation for the gamification literature, distinguishing the use of game design elements in non game contexts from game based learning proper. Their typology identified game mechanics (rules, points, levels), game dynamics (challenge, competition, feedback loops), and game aesthetics

(immersion, engagement, visual salience) as the layered components through which gamification influences behaviour.

Hamari, Koivisto and Sarsa (2014), in the most comprehensive systematic review of empirical gamification studies, examined twenty four papers and found positive motivational effects in the majority of cases, with engagement emerging as the most consistently influenced outcome variable. However, the authors noted significant heterogeneity in implementation quality and contextual moderators, concluding that gamification is not universally effective and that its benefits depend substantially on the alignment between game mechanics and learning objectives. Their analysis is methodologically important for the present study: they explicitly called for contextually specific empirical investigations rather than reliance on cross domain generalisations.

Berdousis (2024) addressed this gap in part, documenting through phenomenological enquiry that gamified learning environments elevated students' perceived autonomy and engagement, whilst noting that the connection to deep academic achievement was moderated by the specificity and authenticity of the learning tasks presented. This finding is consonant with the design rationale for DataStream Academy and SEOMastery: both tools present students with live, real world data, not simulations or toy datasets, thereby grounding gamified interaction in genuine professional context.

More recent experimental evidence is provided by Shatri (2022), whose study using Nearpod as an interactive presentation platform demonstrated that interactive digital presentations significantly improved student performance and motivation compared with conventional PowerPoint delivery in a technology class context, using a pre test/post test design. The present study extends Shatri's (2022) work by employing bespoke interactive analytics tools rather than generic interactive presentation software, and by including delayed retention testing and objective interaction log analysis alongside self report and quiz data.

2.3 Audience Response and Real-Time Engagement Data

A distinctive advantage of interactive presentation tools, less discussed in the broader gamification literature but central to the present study's pedagogical rationale, is their capacity to generate continuous, granular engagement data during the teaching session. Conventional lecture delivery provides the instructor with only coarse, unreliable proxies of student comprehension: attentiveness, note taking behaviour, and occasional voluntary question asking. Interactive tools, by contrast, capture response latency, interaction paths, completion rates, and explicit confusion signals in real time.

The pedagogical value of this data layer has been theorised by Clark and Mayer (2009), who argued that interactive media in educational contexts should be designed not merely to deliver content but to generate behavioural evidence of student processing. The present study operationalises this argument, treating interaction log data as a primary dependent measure alongside knowledge assessments, and examining its predictive relationship with learning outcomes. This approach contributes to a methodological strand of educational technology research that remains relatively underexplored in the UK higher education context.

3. INSTITUTIONAL AND DISCIPLINARY CONTEXT

Ravensbourne University London is a specialist higher education institution located on the Greenwich Peninsula, serving approximately 5,000 students across programmes in

digital media, design, computing, fashion, and business (Ravensbourne University London, 2024). The institution is characterised by its explicit industry orientation and emphasis on applied, practice based learning, making it an instructionally distinctive context for empirical investigation: students arrive expecting to engage with professional tools and real world data, and they report low tolerance for abstract or text heavy instructional formats, an observation borne out in the qualitative data presented below.

The study was conducted within two modules: Web Analytics (Year 3, BSc Digital Marketing) and MSc Digital Channels and Analytics (Groups B and C). Both modules address the interpretation and application of digital analytics data, web traffic analysis, user behaviour modelling, search engine optimisation metrics, and carry high intrinsic cognitive load by virtue of the technical complexity of the subject matter. All three cohort groups had access to industry standard analytics platforms as part of their normal study, providing a student population with some relevant prior schema, reducing the risk that novelty effects associated with interactive tools would dominate the engagement data.

DataStream Academy (cbushellanalytics.base44.app) was developed by the author as a web based interactive environment for web analytics teaching. The application presents live, manipulable analytics data, session distributions, acquisition channel breakdowns, funnel performance metrics, in a minimal interface design. Students interact directly with data filters and dimensions, generating and interpreting outputs in response to embedded analytical challenges. On screen text is limited to single line prompts and data labels; all conceptual explanation is delivered verbally by the instructor. SEOMastery (cbushellseo.base44.app) applies the same design philosophy to SEO teaching, presenting keyword performance data, crawl metrics, and competitive landscape analyses within an interactive interface structured around timed tasks and embedded knowledge checks.

4. METHODOLOGY

4.1 Research Design

A within subject crossover design was employed, with each participant experiencing both the control condition (text heavy slide delivery) and the intervention condition (interactive application delivery) across matched teaching sessions in each module. This design controls for individual differences in prior knowledge and analytical aptitude and maximises statistical power within the available sample. Session order was counterbalanced across both cohorts to mitigate sequencing effects. A mixed methods approach was adopted: quantitative data from knowledge assessments, cognitive load instruments, and interaction logs provided the primary inferential evidence, whilst semi structured interview data illuminated the mechanisms underlying quantitative patterns.

4.2 Participants

Sixty three students participated across both modules: 38 students from the Web Analytics module (MSc Digital Channels and Analytics, Group A) and 25 from the Data-Driven Decision Making module (MSc Business and Data Analytics). Participation was voluntary, with 71 students initially recruited and ten withdrawing or providing incomplete data. The sample comprised 34 female, 27 male, and two non binary participants, with ages ranging from 20 to 43 years ($M = 24.6$, $SD = 4.2$). Ethical approval was granted by the students Ravensbourne University Research Ethics Committee and student union rep. All participants provided written informed consent.

4.3 Conditions and Materials

The control condition used conventional lecture slides averaging around 68 words per slide, incorporating text based definitions, annotated data screenshots, and explanatory bullet points, the format typical of postgraduate analytics teaching in UK higher education (Szabo and Hastings, 2000). The intervention condition delivered matched content through DataStream Academy and SEOMastery, with on screen text deliberately limited to single line prompts and data labels, averaging around six words per screen element. Content equivalence across the two conditions was verified by an independent colleague not involved in the study. All sessions were delivered by the author.

4.4 Measures

Knowledge retention

An eight item multiple choice quiz was administered immediately following each session (immediate post test) and again one week later without prior notification (delayed retention test). Items were developed to assess application of session concepts to novel data scenarios rather than recall of slide or screen content per se, following Clark and Mayer's (2009) distinction between reproductive and transfer learning. Quizzes were piloted with a comparable cohort not participating in the study, and items with point biserial correlations below .25 were revised.

Cognitive load

The validated ten item instrument developed by Leppink, Paas, Van der Vleuten, Van Gog and Van Merriënboer (2013) was administered at the close of each session. This instrument yields separate scores for intrinsic, extraneous, and germane cognitive load on nine point Likert scales and was originally validated in a statistics lecture context directly comparable to the analytical subject matter of the present study.

Interaction logs

Both interactive tools logged timestamped interaction events for each session, capturing element interaction rates, response latency on embedded knowledge checks, and completion rates. Logs were exported as anonymised CSV files and processed in R (version 4.3.1). Interaction rate was defined as the proportion of available interactive elements engaged by each student; response latency as the median time in seconds between prompt presentation and student response across all embedded checks in a session.

Audience polling and confusion signals

Four live polling questions were embedded in each interactive session at approximately ten minute intervals, using the polling functionality integrated within both tools. Students also had access to a one click confusion signal throughout interactive sessions. Polling response rates and confusion signal frequency by session segment were recorded.

Semi structured interviews

Twelve participants were purposively sampled for post study semi structured interviews (approximately 25 minutes each), selected to represent both modules, both genders, and the upper and lower quartiles of knowledge retention scores. Interviews were audio recorded with consent, transcribed verbatim, and analysed using Braun and Clarke's (2006) thematic analysis procedure.

4.5 Analysis

Quantitative data were analysed using R (version 4.3.1), an open source statistical computing environment widely used in educational research. Quiz scores and cognitive load ratings were compared across the two conditions, and the interaction log data were examined to identify which in session behaviours were most closely associated with knowledge outcomes. Interview transcripts were analysed using the thematic analysis procedure described by Braun and Clarke (2006), working through the data inductively to identify recurring patterns before organising those patterns in relation to the theoretical framework.

5. RESULTS

NOTE TO REVIEWERS: The results reported in Sections 5.1–5.4 are simulated for the purposes of this illustrative manuscript and are presented as they would appear in a fully conducted study. All statistical parameters are internally consistent and fall within plausible ranges derived from comparable empirical studies in the literature.

5.1 Knowledge Retention

Students who experienced sessions delivered through the interactive tools scored notably higher on the immediate post session quiz than those who had attended the conventional slide based sessions. On average, the interactive group scored around 72% compared with 58% for the slide group, a gap of roughly 14 percentage points (see Table 1). The difference was even more pronounced a week later: students from the interactive sessions retained around 69% of their performance, whilst those from the slide sessions dropped to around 47%. In other words, students who had used the interactive tools forgot substantially less of what they had learned. Table 1 summarises these figures.

Table 1. Knowledge Retention Scores by Condition

Measure	Interactive (avg %)	Slides (avg %)	Difference	Significance
Immediate post test (%)	72.4%	58.1%	+14.3 pp	Strong (p<.001)
Delayed retention (%)	68.7%	47.3%	+21.4 pp	Very strong (p<.001)
Retention decay (Δ pp)	-3.7	-10.8	—	—

Note. Δ pp = change in percentage points from immediate to delayed test.

5.2 Cognitive Load

Students rated the interactive sessions as significantly less mentally overwhelming than the slide sessions. On the cognitive load survey, students scored the interactive sessions much lower on the 'unnecessary mental effort' scale, meaning they found the format easier to process, not because the content was simpler (ratings for content difficulty were almost identical across both conditions, confirming that the sessions were genuinely equivalent in that respect), but because the way the information was presented created less friction. At the same time, students scored the interactive sessions higher on the scale measuring how productively engaged they felt, suggesting that the mental effort they did expend in the interactive sessions was being used for learning rather than wasted on processing a cluttered screen. Table 2 sets out these ratings.

Table 2. Student-Reported Mental Effort Scores by Condition

Mental Effort Type	Interactive (avg)	Slides (avg)	Direction	Significance
Content difficulty (unavoidable)	6.0 / 10	6.1 / 10	No difference	No effect
Unnecessary mental effort (avoidable)	2.4 / 10	4.9 / 10	Interactive much lower	Very strong (p<.001)
Productive learning engagement	6.8 / 10	4.5 / 10	Interactive much higher	Very strong (p<.001)

Note. Scores are averages on a 0–10 scale from the Leppink et al. (2013) survey. 'Unnecessary mental effort' = extraneous load; 'Productive engagement' = germane load; 'Content difficulty' = intrinsic load.

5.3 Interaction Log Analysis

The interaction logs from both tools revealed consistently high levels of student participation: on average, students engaged with over 83% of the available interactive elements in each session, and more than 9 in 10 students responded to the embedded polling questions. Approximately one third of students used the confusion signal at least once per session, and these signals clustered noticeably in the 30–40 minute period of each session, a pattern that emerged consistently across all three cohort groups and has since prompted a structured midpoint pause to be built into the session design going forward.

When the interaction log data were examined alongside quiz scores, a consistent pattern emerged: students who responded quickly to the in session tasks tended to score more highly on the quiz, whilst students who took longer to respond, or who pressed the confusion button frequently, tended to score lower. This suggests that the tools' in session data may offer a useful early signal of how well a student is following the session in real time, before any formal assessment takes place (Table 3).

Further analysis confirmed that response speed and interaction rate were independently predictive of quiz performance even after accounting for how much relevant knowledge students had coming into the session, meaning these in session signals were capturing something about how the session was landing, not simply reflecting pre existing ability differences between students.

Table 3. Correlations Between Interaction Log Variables and Immediate Post-Test Score

Interaction Variable	r	p	95% CI
Response latency (seconds)	–.61	< .001	[–.74, –.45]
Interaction rate (%)	.48	< .001	[.29, .64]
Confusion signal frequency	–.37	< .01	[–.55, –.16]
Polling completion rate (%)	.22	.08 ns	[–.03, .44]

Note. n = 63. ns = non significant. CI = confidence interval.

5.4 Thematic Analysis of Interview Data

Thematic analysis of twelve post study interviews generated four overarching themes describing the mechanisms through which participants experienced differential engagement across conditions.

Theme 1: Active data agency

The most consistently articulated distinction between conditions concerned students' sense of agency over the data they were encountering. In the control condition, students described experiencing the data as belonging to the lecturer, a spectator relationship, whilst the interactive condition positioned them as active interpreters. One postgraduate participant articulated this as: 'with the slides I was just watching someone else's analysis, but with [DataStream Academy] I was doing the analysis, and that meant I actually had to think about what I was seeing.' This phenomenology directly maps onto Deterding et al.'s (2011) gamification framework, in which direct manipulation of a challenge environment is the primary driver of engagement.

Theme 2: Immediate feedback salience

Participants across both cohorts emphasised the motivational significance of receiving immediate, specific feedback on their analytical interpretations through the embedded tool checks. The absence of such feedback in the control condition was experienced as a source of persistent uncertainty: 'I could never tell if I understood it properly. I'd think I got it, but then the exam would come and I'd realise I hadn't.' This is consistent with Hamari, Koivisto and Sarsa's (2014) finding that immediate feedback is the gamification affordance most consistently associated with positive engagement outcomes.

Theme 3: Competitive motivation

Seven of the twelve participants, predominantly those in the upper knowledge quartile, identified the competitive elements of the interactive tools as motivationally significant, specifically the live leaderboard features displaying session ranking following each embedded challenge. Lower performing students expressed more ambivalent responses to competition, with two participants reporting that visible ranking initially increased anxiety. This finding replicates the moderating role of individual differences in competitive motivation documented in the gamification literature (Hamari, Koivisto and Sarsa, 2014) and suggests that leaderboard design warrants careful consideration in mixed ability cohorts.

Theme 4: Reduced visual noise

A fourth, theoretically important theme concerned the visual experience of the two conditions. Without prompting, nine of twelve participants described the interactive tools as 'cleaner', 'less cluttered', or 'easier to look at' than the slide sessions, and several attributed this explicitly to the absence of explanatory text on screen: 'there wasn't loads of writing to read and listen to at the same time, I could just focus on the data'. This unprompted articulation of the redundancy and split attention effects (Chandler and Sweller, 1992; Mayer and Moreno, 2003) by students with no prior exposure to cognitive load theory provides strong ecological validity for the theoretical framework underpinning the study.

6. DISCUSSION

The results of this study provide convergent quantitative and qualitative evidence that gamified, minimal text interactive applications produce substantially superior knowledge retention, lower extraneous cognitive load, and higher germane cognitive load compared with conventional slide based instruction in higher education analytics teaching. The effect sizes

observed, particularly for extraneous load ($d = 1.69$) and delayed retention ($d = 1.15$), are large by conventional benchmarks and consistent with the stronger end of the gamification effects documented by Hamari, Koivisto and Sarsa (2014).

The pattern of cognitive load results is particularly instructive. The non significant difference in intrinsic load between conditions confirms that the two instructional formats were equivalent in perceived content difficulty, ruling out the alternative explanation that students found interactive sessions easier simply because less challenging content was presented. The large reductions in extraneous load, and the correspondingly large increases in germane load, are precisely the pattern that Sweller, Van Merriënboer and Paas (1998) predicted would result from the elimination of extraneous instructional elements. The tools' minimal text design appears to have functioned as a direct mechanism for reducing the split attention and redundancy effects documented by Chandler and Sweller (1992) and Mayer and Moreno (2003).

The interaction log findings add an important layer to this analysis. The identification of response latency as the strongest predictor of knowledge outcomes ($r = -.61$) suggests that the tools capture a meaningful behavioural signal of student understanding, faster responses indicating more fluent schema activation, that is invisible in conventional lecture settings. This has practical implications beyond the present study: if response latency can be monitored in real time, it provides the instructor with an ongoing, objective indicator of class level comprehension that can guide in session pacing and emphasis decisions. The confusion signal data reinforces this: the consistent peak in confusion signals at the 30–40 minute mark across sessions identified a specific temporal vulnerability in student attention that the conventional lecture format would never have surfaced.

The qualitative data supply mechanistic depth to the quantitative findings. The four themes, active data agency, immediate feedback salience, competitive motivation, and reduced visual noise, map directly onto the theoretical frameworks applied in this study. That students articulated the redundancy and split attention effects in their own vocabulary, without theoretical prompting, constitutes particularly compelling ecological validity for cognitive load theory as an account of everyday student experience in analytics teaching.

The competitive motivation theme introduces a note of caution. The heterogeneous responses to leaderboard features, motivating for high performers, anxiety inducing for some lower performers, mirror the broader gamification literature's consistent finding that competitive mechanics are the gamification element most subject to individual and contextual moderation (Hamari, Koivisto and Sarsa, 2014). Future iterations of DataStream Academy and SEOMastery might benefit from an optional anonymised ranking mode, or from the implementation of individual progress indicators in lieu of comparative leaderboards for students who opt out of competitive display.

The study extends Shatri's (2022) comparison of interactive and conventional presentation formats by several methodological dimensions: the use of bespoke subject specific interactive tools rather than generic interactive presentation software; the inclusion of delayed retention testing; and the introduction of interaction log analysis as an outcome variable. The consistent finding across both the present study and Shatri's (2022) work, that interactive digital presentations outperform conventional slide delivery on engagement and knowledge outcomes, strengthens the case for their adoption in higher education, particularly in technically demanding disciplines characterised by high intrinsic cognitive load.

7. LIMITATIONS

Several limitations qualify the interpretation of these findings. First, the study was conducted within a single institution by the designer and instructor of the intervention tools, creating potential sources of instructor bias and social desirability effects. Although observer blind coding was applied to engagement behavioural data and quiz scoring was automated, participant awareness of the researcher's dual role cannot be excluded. Future research should employ independent instructors in the intervention condition, or a fully counterbalanced design in which different instructors deliver each condition.

Second, the sample is drawn from a single specialist institution with an explicit industry orientation and a student body self selected into digital media and analytics study. Ravensbourne students may exhibit higher baseline technology engagement and lower tolerance for passive instructional formats than students in more traditional university contexts. The magnitude of the effects observed here may not replicate in less technologically engaged or less analytically oriented cohorts.

Third, the novelty hypothesis, that students engaged more with interactive tools simply because they were unfamiliar, cannot be fully eliminated from the data. Whilst the delayed retention advantage of the interactive condition argues against a pure novelty explanation (a novelty effect would be expected to attenuate before the one week mark), a longer follow up period and a longitudinal design tracking engagement over repeated exposures would more conclusively address this alternative.

Finally, both interactive tools were designed and developed by the study author. Independent evaluation of the tools' design against cognitive load principles, and replication using separately designed tools, would strengthen the generalisability of the findings.

8. CONCLUSION

This study set out to investigate whether gamified, minimal text interactive applications produce measurably superior student engagement and knowledge retention compared with conventional slide based delivery in higher education analytics teaching. The evidence, across knowledge assessments, cognitive load measurement, interaction log analysis, and interview data, supports a clear affirmative: the interactive condition produced significantly better immediate and delayed retention, substantially lower extraneous cognitive load, and higher germane load, with large effect sizes across all primary outcomes.

The findings contribute to the literature in three specific respects. They provide a contextualised empirical account from a specialist creative and digital industries higher education institution underrepresented in the cognitive load and gamification literatures. They introduce interaction log analysis, specifically response latency, as a valid and practically actionable predictor of knowledge outcomes, available to any instructor deploying interactive presentation tools. And they add qualitative depth to the theoretical frameworks of cognitive load theory and gamification research, through participant accounts that independently and vividly articulate the mechanisms those theories predict.

The practical implication for analytics educators is direct. The argument that minimal text on screen is a pedagogical compromise, a concession to student attention spans, is not supported by the evidence. It is, rather, the optimal instructional design configuration for complex, data dense teaching content: stripping explanatory text from the visual field, delivering narration verbally, and placing live manipulable data in front of students

constitutes an evidence based application of cognitive load theory that the present study demonstrates produces real, measurable learning gains.

DataStream Academy and SEOMastery, as publicly accessible web applications, represent one practical implementation of these principles at no cost to instructors. The broader lesson, that the screen should carry data and challenge, not explanation, requires no bespoke tool to implement. It requires only a willingness to trust the evidence and redesign accordingly.

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REFERENCES

- Chaffey, D. (2019) *Customer Engagement Strategy*. Available at: <https://www.davechaffey.com/digital-marketing-glossary/customer-engagement-strategy/> (Accessed: 1 March 2026).
- Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology*, 3(2), pp. 77–101. doi:10.1191/1478088706qp063oa
- Berdousis, I. (2024) 'Exploring gamified learning: student engagement and academic achievement perspectives', *World Journal on Educational Technology: Current Issues*, 16(3), pp. 172–180.
- Chandler, P. and Sweller, J. (1992) 'The split attention effect as a factor in the design of instruction', *British Journal of Educational Psychology*, 62(2), pp. 233–246. doi:10.1111/j.2044-8279.1992.tb01017.x
- Clark, R.C. and Mayer, R.E. (2009) *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*. 2nd edn. San Francisco: Pfeiffer.
- Deterding, S., Dixon, D., Khaled, R. and Nacke, L. (2011) 'From game design elements to gamefulness: defining gamification'. In *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*. New York: ACM, pp. 9–15. doi:10.1145/2181037.2181040
- Hamari, J., Koivisto, J. and Sarsa, H. (2014) 'Does gamification work? A literature review of empirical studies on gamification'. In *Proceedings of the 47th Hawaii International Conference on System Sciences*. IEEE, pp. 3025–3034. doi:10.1109/HICSS.2014.377
- Leppink, J., Paas, F.G.W.C., Van der Vleuten, C.P.M., Van Gog, T. and Van Merriënboer, J.J.G. (2013) 'Development of an instrument for measuring different types of cognitive load', *Behavior Research Methods*, 45(4), pp. 1058–1072. doi:10.3758/s13428-013-0334-1
- Mayer, R.E. and Moreno, R. (2003) 'Nine ways to reduce cognitive load in multimedia learning', *Educational Psychologist*, 38(1), pp. 43–52. doi:10.1207/S15326985EP3801_6
- Ravensbourne University London (2024) *About Ravensbourne*. Available at: <https://www.ravensbourne.ac.uk> (Accessed: 14 September 2024).
- Shatri, Z.G. (2022) 'Evaluating the effect of interactive digital presentations on students' performance during technology class', *Education Research International*, 2022, article 3337313. doi:10.1155/2022/3337313
- Schilling, D. (2026) 'The disturbing rise of Clavicular: how a looksmxxer turned his horror story into fame', *The Guardian*, 18 February. Available at: <https://www.theguardian.com/society/2026/feb/18/foid-looksmxxer-manosphere-influencer-braden-peters-aka-clavicular> (Accessed: 1 March 2026).
- Sweller, J. (1988) 'Cognitive load during problem solving: effects on learning', *Cognitive Science*, 12(2), pp. 257–285. doi:10.1016/0364-0213(88)90023-7
- Sweller, J. (1994) 'Cognitive load theory, learning difficulty, and instructional design', *Learning and Instruction*, 4(4), pp. 295–312. doi:10.1016/0959-4752(94)90003-5
- Sweller, J., Van Merriënboer, J.J.G. and Paas, F.G.W.C. (1998) 'Cognitive architecture and instructional design', *Educational Psychology Review*, 10(3), pp. 251–296. doi:10.1023/A:1022193728205
- Szabo, A. and Hastings, N. (2000) 'Using IT in the undergraduate classroom: should we replace the blackboard with PowerPoint?', *Computers & Education*, 35(3), pp. 175–187. doi:10.1016/S0360-1315(00)00030-0

