Survey of Video-based Learning Deployment by Secondary School Teachers

Airil Haimi Mohd Adnan

Universiti Teknologi MARA (UiTM) Shah Alam, 40450 Shah Alam, Selangor, Malaysia

ABSTRACT

This empirical research investigates the use of video-based learning (VBL) amongst secondary school teachers in Malaysia, focusing on instructional video creation, pedagogical value, student engagement strategies and system-wide challenges (a survey was carried out with primary teachers and reported in another paper). Data were collected in 2025 through an online survey involving 253 postgraduate Diploma in Education candidates aged between 26 and 43. The sample reflected Malaysia's multi-ethnicity and comprised 72 males and 181 females. All of the respondents held undergraduate degrees and were completing their final practicum placements as student-teachers. The survey instrument consisted of 32 items structured around four central questions. The findings indicate that whilst a minority of teachers create original contents, such as explainer videos and micro-learning segments, the majority actively source subject-specific VBL materials aligned with the national curriculum. Respondents consistently rated VBL as highly effective in simplifying complex concepts and enhancing visual understanding for students in Forms 1 to 5. Design features such as video length (three to five minutes), real-world examples, age-appropriate presentation and visual signalling techniques were considered effective in sustaining attention and promoting cognitive engagement. However, several barriers to VBL integration were identified. These included limited access to technical infrastructure, insufficient training in video production and time constraints resulting from heavy teaching schedules. The findings highlight the need for targeted professional development, improved system-wide support and consideration of workload issues to enable sustainable adoption of VBL in Malaysian secondary schools.

Keywords: video-based learning, secondary level, education research, survey, Malaysia

INTRODUCTION

The digitalisation of education in Malaysia has prompted shifts in pedagogical approaches, particularly in secondary education where established practices are being reimagined through technology-enhanced methods (Aspandi & Muttaqin, 2025; Chang et al., 2013; Mistretta, 2024; Peter et al., 2025). VBL has surfaced as an especially advantageous pedagogical tool, presenting possibilities for demystifying abstract concepts, strengthening visual comprehension skills, and supporting varied learning tempos among adolescent learners. Although Malaysia's Ministry of Education has committed substantial resources to digital infrastructure development and educational platforms including DELIMa, uncertainties persist regarding the extent to which teachers are successfully embedding VBL within their instructional routines at the secondary level (Ahmad et al., 2019; Mohd Adnan, 2020; Sablić et al., 2021; Yusof et al., 2019).

Teachers working with secondary-aged pupils encounter obstacles in VBL adoption. Producing educationally effective videos demands both technical proficiency and comprehension of developmentally suitable design conventions appropriate for learners in Forms 1 through 5 (see Karim, Adnan, Salim, et al., 2020; Karim, Adnan, Tahir, et al., 2020; Mustafa Kamal et al., 2019; Shah et al., 2025). Nevertheless, a substantial proportion depend primarily upon pre-existing curated materials rather than producing customised content responsive to their particular classroom circumstances. Notwithstanding increasing institutional emphasis on VBL implementation, empirical investigations analysing teachers' authentic deployment patterns, perceptions of instructional efficacy, and obstacles to successful integration remain scarce (Adnan, 2020; Adnan et al., 2020; Adnan & Ahmad et al.,

2019; Adnan & Karim et al., 2019; Mohd Kamal et al., 2019). The present investigation fills this void by examining responses from 253 postgraduate Diploma in Education candidates completing their placements in local secondary schools, exploring four domains: practices surrounding content generation, perceptions of pedagogical utility, design elements supporting learner engagement, and systemic impediments to implementation.

LITERATURE REVIEW

VBL implementation exhibits considerable variation across educational settings, especially in developing nations where infrastructural capacity and educator readiness demonstrate notable inconsistency (Alazmi, 2023; Snoeyink, 2010). This section synthesises existing scholarship across four interconnected areas that establish the conceptual foundation for examining Malaysian secondary teachers' VBL practices.

Teachers' VBL content creation and resource ecology

Within pedagogical environments, scholarly work by Meng et al. (2022) and Yousef et al. (2014) distinguishes between educators who generate original educational materials and those who select pre-existing resources. Empirical evidence indicates that instructor-generated video contents often yield enhanced learning outcomes owing to contextual relevance and curriculum-specific alignment (de Araujo et al., 2017; Pegrum & Bower, 2021; Torrington et al., 2021). This occurs notwithstanding the extensive collections of educational videos accessible through platforms including YouTube and institutional repositories. However, video production demands temporal investment, technical capability, and organisational backing that might be limited across numerous educational settings (Hsu et al., 2022; Ramos et al., 2022). Research by Tembrevilla and MilnerBolotin (2025) further reveals that educators throughout Southeast Asian contexts exhibit reliance upon externally sourced educational videos, prompting concerns regarding the cultural appropriateness and contextual relevance of these contents.

Perceived usefulness and cognitive clarity

Drawing upon Granić and Marangunić's (2019) scholarship, the Technology Acceptance Model identifies perceived utility as a determinant of technology uptake among educational practitioners. Advocates contend that visual modalities enhance understanding of abstract subject matter, particularly benefiting teenage learners who gain advantages from multimodal instructional approaches (McTighe & Ferrara, 2021; Shih, 2010). Proponents of VBL maintain that such approaches facilitate learners' comprehension of conceptually challenging material (Hußner et al., 2024). Investigations into cognitive load conducted by Costley et al. (2021) and Faber et al. (2024) demonstrate that thoughtfully constructed video segments support knowledge scaffolding whilst concurrently minimising extraneous cognitive processing demands. Within the Malaysian context, empirical evidence examining educators' perceptions of VBL's pedagogical efficacy relative to traditional 'old school' methods remains limited (Mohd Adnan, 2025a).

Effectiveness of engagement features for secondary students

Scholarly literature indicates that instructional videos designed for secondary-level learners should maintain durations approximating three to five minutes to optimise attention and comprehension (Allen, 2016; Omar, 2025). Design frameworks for pedagogically sound educational videos emphasise the importance of conciseness (Gentile et al., 2025). Evidence demonstrates that signalling mechanisms, including on-screen arrows, highlighted text, and annotations, effectively guide learner attention and strengthen retention (Currie, 2013; Mercier & Higgins, 2013). Furthermore, conversational delivery and appropriate humour demonstrate potential for enhancing engagement, though cultural context also influences the suitability of such elements (BernadMechó & Girón-García, 2023; Qamar et al., 2025). That being said, whilst gamification is gaining prominence, its implementation requires consideration to avoid cognitive distractions when it is combined with VBL (Mistry, 2022; Nickl et al., 2022).

System-wide and training barriers to VBL integration

According to Hasin and Nasir (2021) and Mohd Adnan (2025b, 2025c), Malaysian educational institutions persistently encounter significant infrastructural limitations. These encompass unreliable internet connectivity and inadequate hardware provision, both of which impede effective technology utilisation. Beyond technical obstacles, educators report insufficient professional development opportunities for digital content creation and ambiguous institutional policies governing VBL integration (Major & Watson, 2018). Despite administrative support being critical for sustainable adoption, some schools lack dedicated resources or implementation frameworks for VBL deployment (Ketelhut & Schifter, 2011; Owston, 2007). Effectively addressing these challenges necessitates coordinated policy initiatives that prioritise both capacity development and infrastructural investment.

Conceptual framework and rationale

Drawing upon the reviewed literature, this study proposes a triadic framework for understanding VBL adoption amongst secondary school teachers (Figure 1). The framework positions pedagogical conviction as the foundational driver, representing teachers' beliefs about VBL's educational value and its alignment with contemporary learning needs. This conviction, however, operates within institutional contexts that either enable or constrain implementation through resource availability, administrative support, and professional development opportunities. Simultaneously, teachers' confidence-efficacy mediate the translation of conviction into practice, encompassing their self-assessed competence and instructional design capabilities.

The framework illustrates three critical interaction pathways. Firstly, institutional barriers can erode pedagogical conviction when systemic constraints repeatedly prevent successful implementation, leading to resignation or scepticism. Secondly, inadequate institutional support exacerbates confidence-efficacy gaps by denying teachers the training and resources needed to build competence. Thirdly, low confidence-efficacy can diminish the influence of pedagogical conviction, as teachers who believe in VBL's value may nonetheless avoid adoption due to anticipated implementation failures. These interactions create a dynamic system where weakness in any dimension undermines overall adoption, whilst strength in all three dimensions creates synergistic conditions for sustained VBL integration. This framework guided the development of research instruments and analysis of factors shaping Malaysian secondary teachers' VBL adoption decisions.
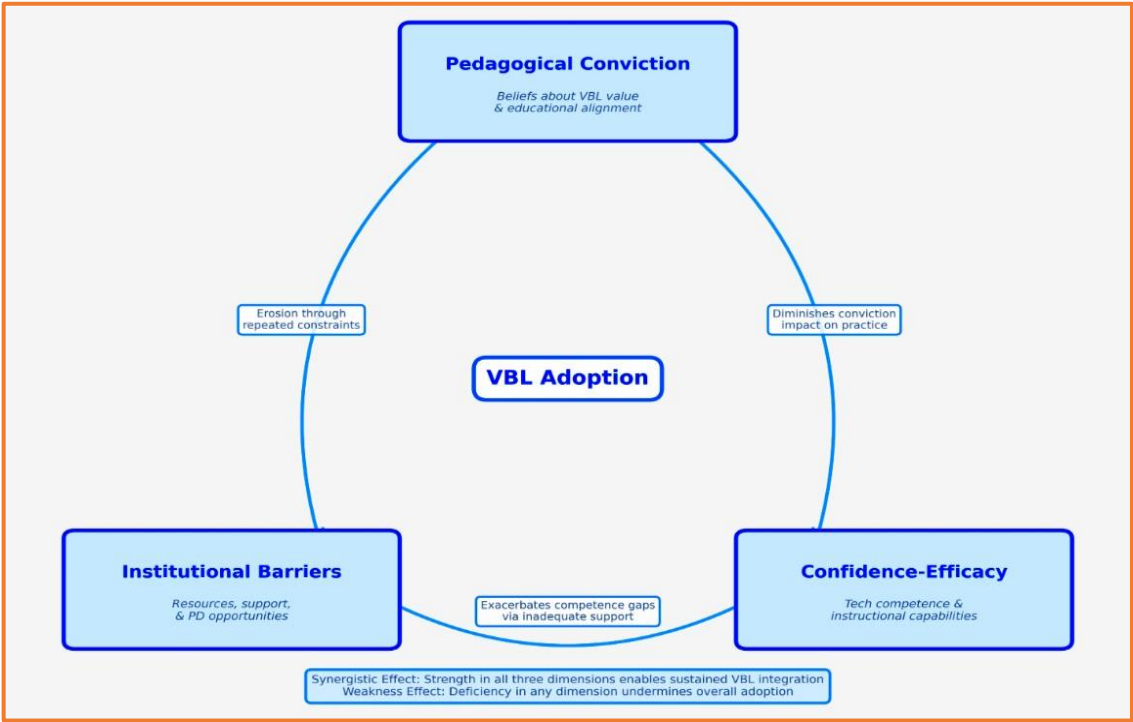

Figure 1. Triadic framework for VBL adoption amongst secondary school teachers

This study addresses gaps in VBL implementation among Malaysian secondary school teachers by examining content creation, pedagogical effectiveness, design characteristics, and implementation obstacles. Whilst international scholarship provides theoretical foundations for VBL efficacy, data specific to the Malaysian secondary context is limited, particularly regarding the lived experiences of teachers as both video creators and content curators. 253 postgraduate Diploma in Education candidates were surveyed, all practising or prospective secondary level teachers, to understand their perspectives within local classrooms. Four questions guided the collection, analysis, and discussion:

RQ1: To what extent do Malaysian secondary teachers create original instructional videos compared to relying on curated resources from YouTube or DELIMa?

RQ2: How effectively does VBL simplify difficult curriculum concepts and enhance visual comprehension for Forms 1 to 5 students compared to 'old school' methods?

RQ3: Which VBL design elements (duration, signalling, real-world examples, age-appropriate presentation, visual cues) most effectively maintain student attention and engagement?

RQ4: What system barriers (infrastructural, administrative support, training, workload constraints) most significantly hinder teachers' integration of VBL into teaching practices?

METHODOLOGY

Research design

This investigation employed a quantitative survey methodology to examine Malaysian secondary teachers' VBL adoption patterns, perceptions, and challenges. The cross-sectional design facilitated systematic data gathering across varied geographical and demographic contexts, yielding a snapshot of current practices and attitudes towards VBL implementation in secondary education.

Survey respondents

Data collection happened in 2025 involving 253 postgraduate Diploma in Education candidates enrolled at a prominent Malaysian university. Respondents ranged in age from 26 to 43 years, with 181 identifying as female and 72 as male. The cohort represented Malaysia's multiethnic composition, including respondents from the two

Borneo states, thus ensuring substantial geographical representation. All of them possessed undergraduate qualifications from public or private higher education institutions, fulfilling the mandatory entry criteria for the postgraduate programme. Significantly, the majority were engaged in completing their practicum placements, establishing them as student-teachers with contemporary and direct instructional experience in secondary schools (Forms 1 to 5).

Research instrument

The web-based survey comprised 32 items structured around four research questions, employing a five-point Likert scale extending from Strongly Disagree (1) to Strongly Agree (5). The instrument was organised into four domains: content creation and resource ecology (RQ1, 8 items), perceived usefulness and cognitive clarity (RQ2, 7 items), effectiveness of engagement features (RQ3, 9 items), and systemic and training barriers (RQ4, 8 items). Items were crafted to capture both behaviour (e.g., regularity of original content creation) and attitudes (e.g., perceived efficacy of particular design components). The instrument underwent pilot testing with 39 comparable respondents in 2024 to verify clarity and suitability before comprehensive deployment. Following the pilot, refinements were done to enhance item comprehensibility for future respondents.

Internal consistency reliability for each domain was evaluated using Cronbach alpha: RQ1 (alpha = 0.96), RQ2 (alpha = 0.96), RQ3 (alpha = 0.96), and RQ4 (alpha = 0.98). All domains demonstrated reliability (alpha > 0.90), substantiating the survey's robust internal consistency. Construct validity was assessed through exploratory factor analysis (EFA) employing principal axis factoring with oblique rotation (Promax). The Kaiser-MeyerOlkin measure confirmed sampling adequacy (KMO = 0.93), and Bartlett test of sphericity yielded

significant results (chi-square = 7618.48, p < .001), validating appropriateness of factor analysis. The EFA produced a fourfactor solution explaining 60.1% of total variance, corresponding with the instrument's theoretical framework. Factor loadings ranged from 0.40 to 0.86, with items demonstrating significant loadings (> 0.40) on their designated constructs whilst exhibiting minimal cross-loadings (< 0.30).

Data analysis procedures

Descriptive statistics, encompassing means, standard deviations, and frequency distributions, were computed for all survey items. Means are presented with 95% confidence intervals to convey estimate precision. Inferential statistics, incorporating skewness values to evaluate distribution normality, were calculated to discern response patterns across the domains under investigation.

Effect sizes were determined using Cohen's d to ascertain the practical significance of deviations from the scale midpoint (neutral = 3.0). Adhering to Cohen (1988) conventions, effect sizes were categorised as negligible (d < 0.20), small (d = 0.20-0.49), medium (d = 0.50-0.79), large (d = 0.80-1.19), or very large (d >= 1.20). This approach permitted evaluation of not merely statistical significance but equally the magnitude of teachers' perceptions and attitudes. Data were analysed using SPSS Statistics (Version 29.0), with specific emphasis placed on identifying patterns across the research queries.

Ethics and limitations

Prior to data collection, respondents were informed that participation was voluntary and informed consent was obtained; anonymity and confidentiality were preserved. Limitations encompass dependence on self-reported data, which may be susceptible to social desirability bias, and the particular demographic profile of the studentteachers, whose perspectives may diverge from more experienced practitioners. Additionally, the focus on perceptions rather than observable instructional practices constrains conclusions regarding actual VBL implementation. Finally, it is essential to acknowledge that the cross-sectional design precludes causal inferences concerning relationships between variables.

FINDINGS

Demographic characteristics

The investigation surveyed 253 postgraduate Diploma in Education candidates over three academic semesters. Participants ranged in age from 26 to 43 years, with females constituting the majority (181 respondents, 71.5%) and males comprising 72 respondents (28.5%). The cohort exhibited ethnic diversity, encompassing various Malaysian communities including representation from Sabah and Sarawak. All participants possessed undergraduate qualifications from Malaysian universities, satisfying the mandatory entry requirements for the postgraduate programme. Figure 2 presents an overview of the respondents' demographic characteristics.

DEMOGRAPHIC VARIABLE	DESCRIPTION
Sample Size	253 postgraduate Diploma in Education candidates
Data Collection Period	Three academic semesters in 2025
Age Range	26 to 43 years
Gender Distribution	Female: 71.5% (n=181); Male: 28.5% (n=72)
Ethnicity	Diverse representation across Malaysian ethnicities, including participants from Sabah and Sarawak
Educational Background	All hold undergraduate degrees from Malaysian public or private universities (minimum entry requirement)
Professional Status	Student-teachers; majority completing final practicum placements in secondary schools during data collection
Teaching Level	Secondary education (Forms 1 to 5)
Survey Format	Online survey with 32 items using five-point Likert scale (Strongly Disagree to Strongly Agree)

Figure 2. Demographic characteristics of the survey respondents (n = 253)

A distinguishing feature of this cohort was their dual identity as postgraduate learners and practising educators. Most were undertaking their mandatory teaching placements in schools throughout the data collection phase, positioning them as student-teachers possessing immediate, experiential classroom engagement. This proximity to active instructional practice ensured their responses mirrored contemporary pedagogical circumstances rather than detached theoretical understanding. Their concurrent exposure to university-delivered pedagogical instruction and school-situated practical implementation rendered them exceptionally well-positioned to assess VBL adoption behaviours, efficacy perceptions, and implementation obstacles within the present-day Malaysian educational context.

RQ1: Teacher VBL creation and resource ecosystem

Responses revealed limited engagement with original video creation amongst secondary teachers (Figure 3). Only 11.1% strongly agreed they create their own explainer or micro-learning videos, whilst combined disagreement (34.0%) marginally exceeded combined agreement (38.0%), yielding a near-neutral mean of 3.04 (95% CI [2.89, 3.19], Cohen's d = 0.03). Confidence in producing age-appropriate content for Forms 1 to 5 learners proved modestly higher (M = 3.20, 95% CI [3.06, 3.34], d = 0.18), with 32.8% agreeing they felt confident and 9.9% strongly agreeing. Yet, substantial proportions remained neutral (31.2%) or expressed disagreement (26.1% combined).
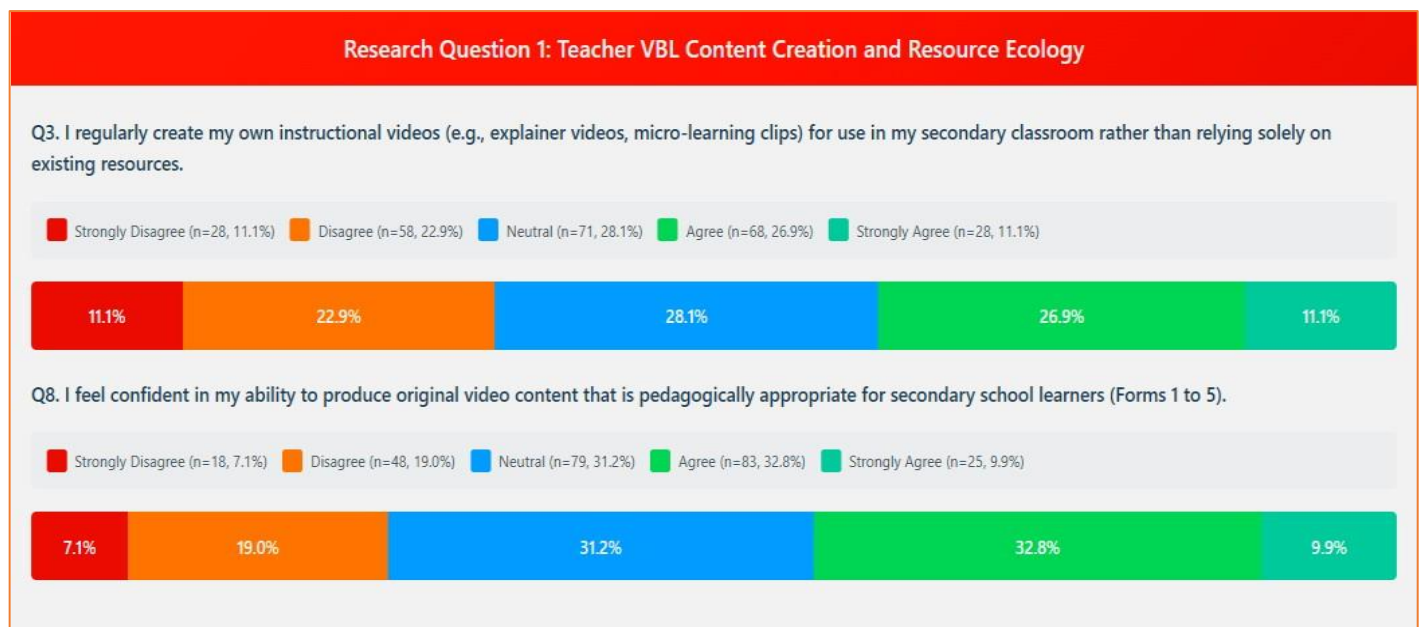

Figure 3. Teacher VBL content creation practices and confidence levels (Q3 and Q8)

These patterns reveal a confidence-efficacy gap wherein technical barriers, curricular pressures and time constraints discourage systematic video production despite teachers' subject-matter expertise. The symmetrical distributions (skewness values of 0.02 and −0.15 respectively) suggest that hesitancy towards content creation transcends demographic or disciplinary boundaries. If student-teachers with contemporary training express such modest confidence, more senior teachers with 'traditional' professional development likely face even greater self-efficacy challenges in the here and now.

RQ2: Perception of usefulness and pedagogical clarity

The teachers in the survey demonstrated conviction regarding VBL's pedagogical effectiveness for secondary learners (Figure 4). Visual representations' capacity to enhance comprehension of abstract concepts received exceptional endorsement (M = 4.23, 95% CI [4.14, 4.32], d = 1.71), with 87.3% combined agreement and pronounced negative skewness (−1.05). Similarly, teachers strongly endorsed VBL's effectiveness in addressing diverse learning abilities and styles within mixed-ability classrooms (M = 3.98, 95% CI [3.88, 4.08], d = 1.20), with 77.9% combined agreement and negative skewness (−0.79). These large effect sizes indicate that teachers perceive VBL as genuinely transformative rather than marginally beneficial.
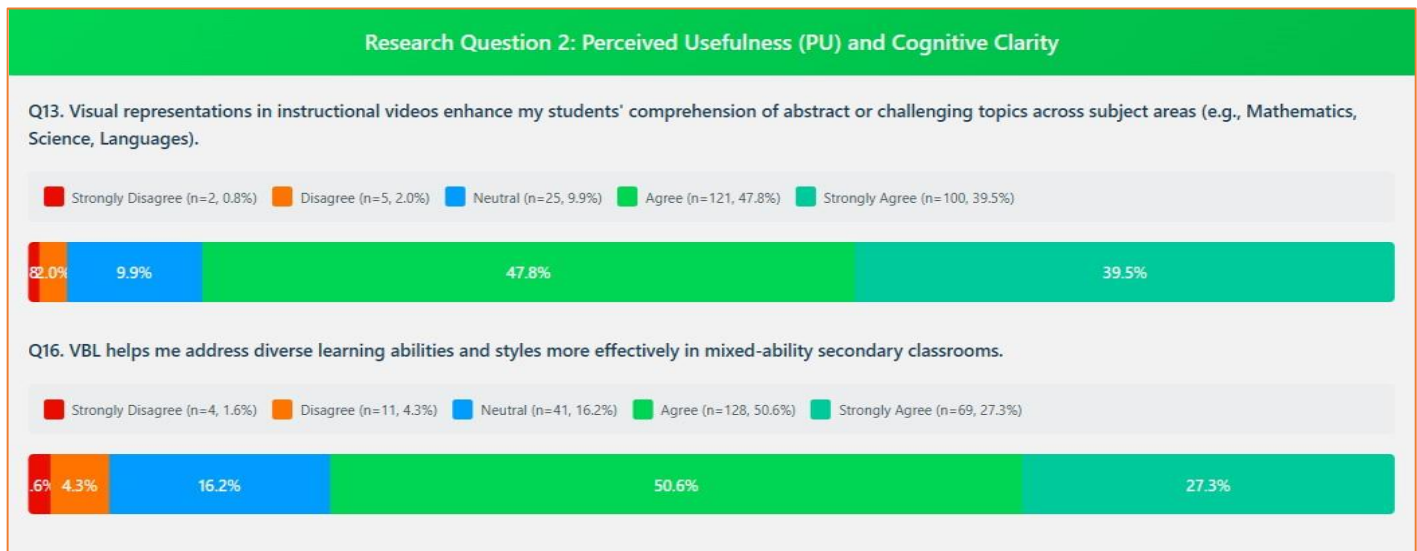
Figure 4. Perceived pedagogical effectiveness of VBL for secondary students (Q13 and Q16)

These teachers evidently recognise that visual elements such as animations, diagrams and illustrative examples provide Forms 1 to 5 students with cognitive scaffolding that verbal explanations alone cannot achieve, whilst simultaneously enabling self-paced learning, permitting content review and providing multiple representational formats. This proves valuable for abstract mathematical, scientific or theoretical contents requiring visual expression, and for accommodating considerable variations in prior knowledge, language proficiency and learning preferences typical of Malaysian secondary classrooms.

RQ3: Success of engagement features for secondary students

Further, they endorsed specific design elements as crucial for maintaining secondary students' attention and engagement (Figure 5). Brief video durations (three to five minutes) received strong consensus (M = 3.98, 95% CI [3.87, 4.09], d = 1.10), with 77.0% combined agreement and negative skewness (−0.88), reflecting practical wisdom that adolescents require frequent instructional format changes despite possessing better cognitive maturity than primary-aged children. Age-appropriate contents and relevant examples garnered even stronger endorsement (M = 4.27, 95% CI [4.18, 4.36], d = 1.79), representing the investigation's highest score, with 88.2% agreement and pronounced negative skewness (−1.08). These large effect sizes confirm that the teachers view both brevity and developmental appropriateness as genuinely consequential rather than merely preferable.
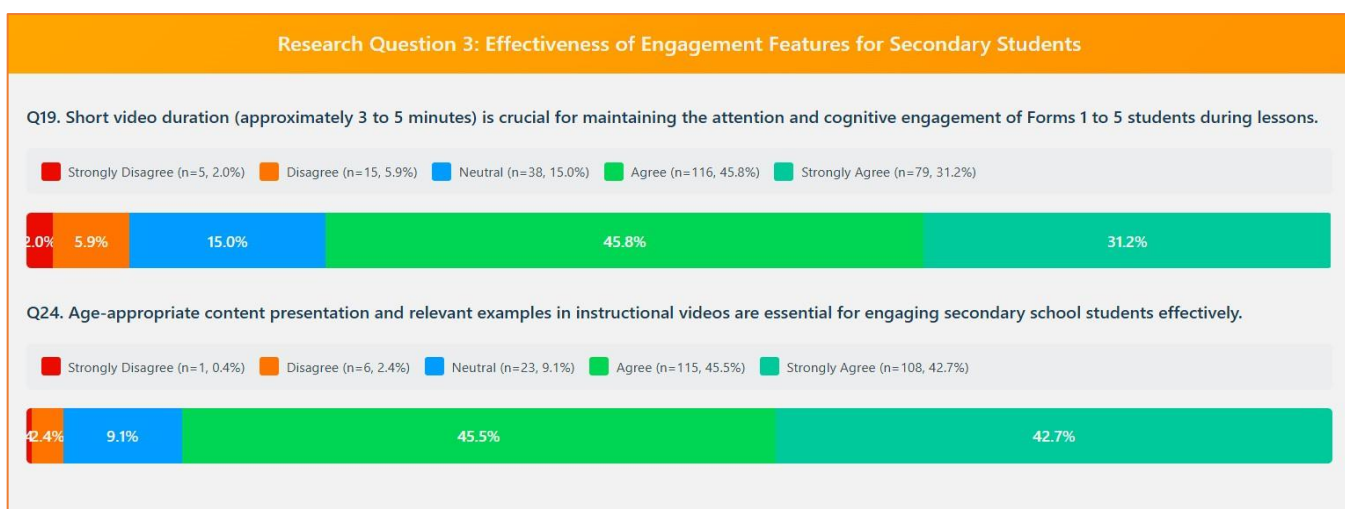

Figure 5. Critical design elements for secondary student engagement (Q19 and Q24)

They evidently recognise that pedagogically sound video design must extend beyond content accuracy to encompass contextual relevance for teenage students, acknowledging their emerging abstract reasoning

capabilities whilst respecting developmental characteristics and cultural backgrounds. This challenges the notion that generic educational videos can engage Forms 1 to 5 students if examples, language register or presentational style prove quite mismatched with adolescent cognitive and social-emotional development.

RQ4: Institutional and training hurdles to VBL integration

Systemic barriers emerged as critical obstacles to VBL integration (Figure 6). Training deficits constituted a substantial impediment, with 73.5% of respondents agreeing that insufficient professional development in rapid video creation and pedagogically sound VBL design limits their capacity (M = 3.88, 95% CI [3.77, 3.99], d = 0.95). Time constraints and demanding workloads proved more acute (M = 3.99, 95% CI [3.88, 4.10], d = 1.14), with 77.8% agreement. Both domains demonstrated negative skewness (−0.71 and −0.76 respectively) and large effect sizes, emphasising magnitude and consensus.

These findings prove noteworthy given that the respondents were mostly postgraduate candidates actively receiving pedagogical training; if they report inadequate preparation, senior teachers likely face greater gaps. The former requires specific technical and pedagogical guidance addressing rapid content creation workflows suitable for time-pressed practitioners, age-appropriate design principles and practical strategies for integrating videos into the secondary curriculum. The tension between institutional rhetoric emphasising digital learning and teachers' capacity to engage meaningfully with VBL remains constrained by workload pressures, extensive curriculum coverage requirements, examination preparation demands (particularly for the secondary schoolleaving examination or *SPM*), co-curricular responsibilities and administrative duties. Addressing this necessitates coordinated interventions including readjusted teacher workload allocations and dedicated time for digital resource development.
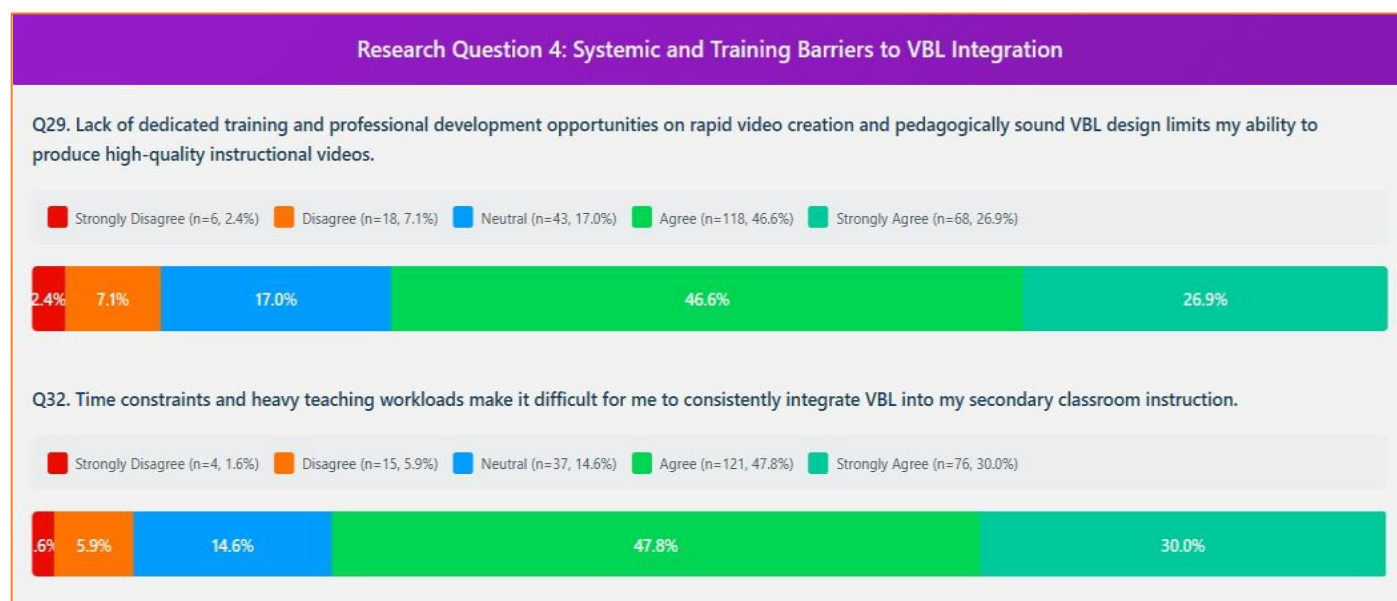

Figure 6. Systemic barriers to wider VBL integration in secondary schools (Q29 and Q32)

DISCUSSION

This empirical effort examined VBL adoption amongst 253 Malaysian secondary teacher-candidates, revealing insights into content creation practices, pedagogical perceptions, design priorities, and also implementation barriers. The findings illuminate both opportunities and constraints shaping VBL integration within Forms 1 to 5 classrooms (Figure 7).

Theoretical integration: TAM and CLT as explanatory frameworks

Findings demonstrate alignment with established theoretical frameworks, particularly the Technology Acceptance Model and Cognitive Load Theory, whilst also revealing contextual factors that extend these models

within Malaysian secondary education. TAM posits that perceived usefulness and perceived ease of use determine technology adoption intentions (Granić & Marangunić, 2019). The present data confirm TAM's predictive validity with the teachers' endorsement of VBL's pedagogical effectiveness (RQ2 findings) representing high perceived usefulness, yet modest content creation engagement (RQ1 findings) reflects low perceived ease of use.

This misalignment creates the confidence-efficacy gap observed. Simultaneously, the teachers' design preferences validate CLT principles with their endorsement of brief durations (M = 3.98, d = 1.10) and visual scaffolding (M = 4.23, d = 1.71) directly aligning with CLT's emphasis on managing cognitive load through concise, multimodal presentations that reduce extraneous processing demands whilst optimising germane cognitive load for schema construction (Costley et al., 2021; Faber et al., 2024). However, the findings equally reveal that system-wide barriers (training deficits and workload constraints) moderate TAM's predictive pathways, suggesting that institutional context mediates the relationship between perceived usefulness and actual adoption.

'Confidence-efficacy gap' in content creation

Despite encouragement of digital innovation, the teachers demonstrated limited engagement with original video production. The near-neutral response (M = 3.04) and negligible effect size (d = 0.03) regarding content creation, coupled with modest confidence levels (M = 3.20, d = 0.18), reveal a confidence-efficacy gap that validates TAM's perceived ease of use construct. Perceived ease of use functions as a critical determinant of technology adoption intentions; when users perceive technologies as demanding excessive effort, adoption falters regardless of perceived usefulness (Granić & Marangunić, 2019).

The present findings exemplify this dynamic as the teachers recognise VBL's pedagogical value yet avoid content creation owing to anticipated difficulties. This pattern suggests that technical barriers and self-efficacy concerns outweigh teachers' subject-matter expertise advantages. Notably, even student-teachers with updated pedagogical training expressed uncertainty, indicating that technology integration courses prove insufficient for developing video production competencies specific to teenagers. This gap aligns with research by Tembrevilla and Milner-Bolotin (2025) documenting Southeast Asian teachers' reliance on external resources, though the present data reveal that secondary teachers' hesitancy stems less from content availability than from confidence deficits and workload pressures. Certainly, pedagogical convictions alone cannot drive adoption, and without addressing perceived ease of use through targeted training and systemic support, VBL integration remains merely aspirational.
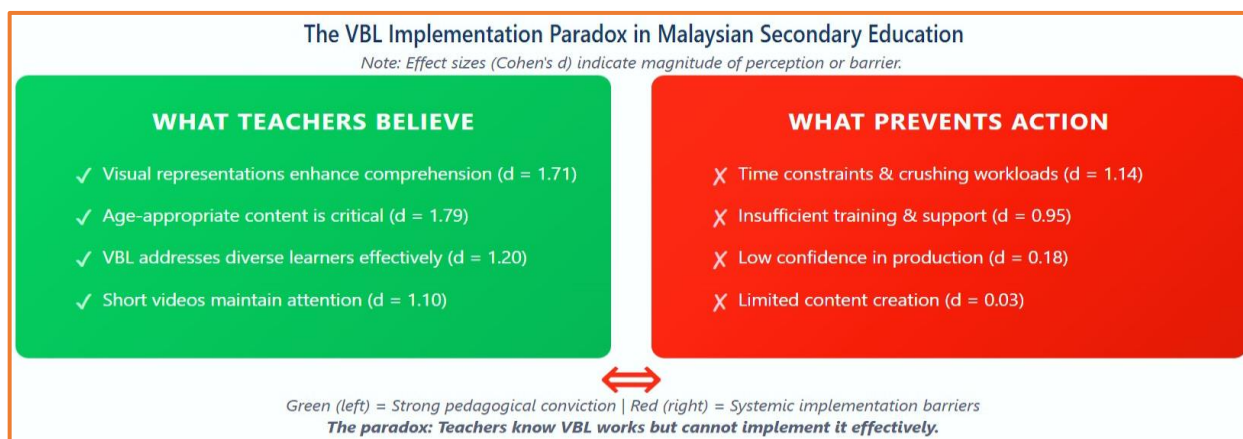

Figure 7. Empirical findings on the deployment of VBL by secondary school teachers Strong pedagogical endorsement despite implementation constraints.

Paradoxically, whilst the teachers showed limited content creation engagement, they expressed conviction regarding VBL's pedagogical value. Visual representations received exceptional endorsement (M = 4.23, d = 1.71), whilst age-appropriate presentation garnered the investigation's largest effect (M = 4.27, d = 1.79). These

findings validate TAM's prediction that perceived usefulness constitutes a primary adoption driver, yet simultaneously expose its limitations. They clearly recognise VBL's capacity to enhance comprehension, accommodate diverse learners (d = 1.20) and sustain attention through brief, focused segments (d = 1.10). Their design preferences equally validate CLT principles, particularly regarding cognitive load management. CLT posits that effective instruction minimises extraneous cognitive load (irrelevant processing) whilst optimising germane cognitive load (schema) through representational formats (Costley et al., 2021; Faber et al., 2024). The teachers' endorsement of brief durations directly reflects CLT's emphasis on preventing cognitive overload, whilst their valuation of visual scaffolding aligns with the dual-coding principle that multimodal presentations enhance schema formation more effectively than unimodal ones.

The disconnect between pedagogical conviction (high perceived usefulness) and implementation practice (low perceived ease of use) reveals that adoption barriers are systemic rather than attitudinal. The teachers understand VBL's affordances, yet lack the infrastructural support, dedicated time and targeted training.

Systemic barriers requiring coordinated interventions

Time constraints (M = 3.99, d = 1.14) and training deficits (M = 3.88, d = 0.95) emerged as substantial obstacles, with effect sizes indicating large practical significance. These system-wide barriers function as moderating variables within TAM's predictive pathways, constraining the relationship between perceived usefulness and adoption intentions. Malaysian secondary teachers do face acute workload pressures from curriculum demands, examination responsibilities (particularly SPM requirements) and administrative duties that constrain capacity for resource development. These constraints nullify high perceived usefulness as the teachers recognise VBL's pedagogical value yet cannot allocate time for it. Similarly, inadequate professional development suppresses perceived ease of use by denying teachers the technical competencies and pedagogical strategies necessary for confident VBL integration.

Addressing these barriers necessitates coordinated policy responses that acknowledge technology adoption as an institutionally situated process rather than an individual decision. The triadic framework proposed earlier (Figure 1) captures this complexity where pedagogical conviction (perceived usefulness), confidence-efficacy (perceived ease of use) and institutional barriers function as interdependent determinants of VBL adoption. Without coordinated interventions addressing these dimensions, the confidence-efficacy gap will persist, and VBL's recognised pedagogical advantages will remain largely unrealised in Malaysian secondary classrooms.

CONCLUSION

This empirical research effort reveals a paradox within Malaysian secondary education that whilst teachers overwhelmingly recognise VBL's transformative pedagogical potential for Forms 1 to 5 learners, system-wide constraints prevent meaningful implementation. The exceptionally large effect sizes for visual representations (d = 1.71) and age-appropriate presentation (d = 1.79) demonstrate that the teachers in this study view videobased approaches as substantially more effective than traditional methods for enhancing comprehension, accommodating diverse abilities and sustaining adolescent attention. Yet their conviction remains largely unrealised owing to inadequate professional development, workload pressures and self-efficacy deficits. The confidence-efficacy gap documented exposes the current misalignment between institutional rhetoric and systemic realities.

Addressing this paradox demands coordinated interventions. Firstly, the Ministry of Education should mandate subject-specific VBL professional development workshops acknowledging secondary education's distinctive demands. Mathematics teachers require guidance on visualising algebraic functions, whilst science teachers need training in demonstrating laboratory procedures through video. Workshops should emphasise rapid content creation using accessible tools (e.g., Canva, CapCut), focusing on three-to-five-minute formats aligned with cognitive load principles, delivered through face-to-face sessions with ongoing mentoring. Secondly, the DELIMa platform should be enhanced with dedicated VBL professional modules featuring micro-credentialing systems. These should progress from foundational skills (curating materials) through intermediate skills (adapting videos) to advanced skills (creating contents). Thirdly, workload restructuring proves essential. Time constraints (d = 1.14) constitute the most substantial barrier; 'free' weekly periods specifically for resource

development must be mandated. Subject-specific VBL development teams should also receive administrative recognition through reduced clerical-work responsibilities. Lastly, infrastructure investments must include dedicated video production spaces with basic equipment (ring lights, tripods, microphones), technical support and reliable connectivity, particularly in rural contexts.

These empirically grounded recommendations address the confidence-efficacy gap through coordinated interventions. Malaysian educational authorities must move beyond aspirational rhetoric towards concrete, resourced actions that simultaneously build teacher capacity, restructure workload expectations and strengthen institutional support. In truth, secondary students navigating complex curriculum content require multimodal instructional approaches. Ultimately, this study demonstrates that teachers understand these imperatives yet lack the capacity to respond. Realising VBL's potential necessitates system-wide transformation, not merely individual teacher initiative.

REFERENCES

1. Adnan, A. H. M. (2020). From interactive teaching to immersive learning: Higher Education 4.0 via 360degree videos and virtual reality in Malaysia. IOP Conf. Ser.: Mater. Sci. Eng., 917, 012023.
2. Adnan, A. H. M., Ahmad, M. K., Yusof, A. A., Mohd Kamal, M. A., & Mustafa Kamal, N. N. (2019).
3. English Language Simulations Augmented with 360-degrees spherical videos (ELSA 360°- Videos): 'Virtual Reality' real life learning! In MNNF Publisher (Ed.), Leading Towards Creativity & Innovation (Series 1) (pp. 82.88). MNNF Publisher.
4. Adnan, A. H. M., Karim, R. A., Tahir, M. H. M., Kamal, N. N. M., & Yusof, A. M. (2019). Education 4.0 technologies, industry 4.0 skills and the teaching of English in Malaysian tertiary education. Arab World English Journal, 10(4), 330-343.
5. Adnan, A. H. M., Ya Shak, M. S., Karim, R. A., Tahir, M. H. M., & Shah, D. S. M. (2020). 360-degree videos, VR experiences and the application of Education 4.0 technologies in Malaysia for exposure and immersion. Adv. Sci. Technol. Eng. Syst. Journal, 5(1), 373-381.
6. Ahmad, M. K., Adnan, A. H. M., Azamri, N. M., Idris, K. B., Norafand, N. N., & Ishak, N. I. (2019). Education 4.0 technologies for English language teaching and learning in the Malaysian context. Paper presented at the International Invention, Innovative & Creative Conference (InIIC Series 2/2019), Kuala Lumpur, Malaysia.
7. Alazmi, H. S. (2023). The value of systematic, iterative, video-based reflection analysis on preservice teacher actions in Kuwait: A preservice social studies teacher example. Teaching and Teacher Education, 121, 103910.
8. Allen, M. (2016). The best ways to teach primary science: Research into practice. McGraw-Hill Education (UK).
9. Aspandi, A., & Muttaqin, M. A. (2025). Transforming Teacher Roles in Indonesia's Digital Era: Enhancing Learning Effectiveness and Student Engagement. Journal of General Education and Humanities, 4(4), 1495-1510.
10. Bernad-Mechó, E., & Girón-García, C. (2023). A multimodal analysis of humour as an engagement strategy in YouTube research dissemination videos. The European Journal of Humour Research, 11(1), 46-66.
11. Chang, Y. F., Chen, Y. C., Chang, M. F., & Hsu, C. L. (2013). Development of a VBL system to enhance student teachers' technology integration competencies. Communications in Information Science and Management Engineering, 3(7), 336.
12. Cohen, J. E. (1988). Statistical Power Analysis for the Behavioral Sciences. Lawrence Erlbaum Associates, Inc.
13. Costley, J., Fanguy, M., Lange, C., & Baldwin, M. (2021). The effects of video lecture viewing strategies on cognitive load. Journal of Computing in Higher Education, 33(1), 19-38.
14. Currie, J. (2013). Teaching physical education in primary school: An integrated health perspective. Acer Press.
15. de Araujo, Z., Otten, S., & Birisci, S. (2017). Teacher-created videos in a flipped mathematics class: digital curriculum materials or lesson enactments? ZDM, 49(5), 687-699.

16. Faber, T. J., Dankbaar, M. E., van den Broek, W. W., Bruinink, L. J., Hogeveen, M., & van Merriënboer, J. J. (2024). Effects of adaptive scaffolding on performance, cognitive load and engagement in game-based learning: a randomized controlled trial. BMC Medical Education, 24(1), 943.

17. Gentile, M., Agrusti, G., Fiorilli, C., Ghezzi, V., & Toti, G. (2025). Video-based learning activities in teacher education: effects on self-efficacy and perception of feedback for learning. Journal of e-Learning and Knowledge Society, 21(1), 74-84.

18. Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. British Journal of Educational Technology, 50(5), 2572-2593.

19. Hasin, I., & Nasir, M. K. M. (2021). The Effectiveness of the Use of Information and Communication Technology (ICT) in Rural Secondary Schools in Malaysia. Journal of Education and e-Learning Research, 8(1), 59-64.

20. Hsu, F. H., Lin, I. H., Yeh, H. C., & Chen, N. S. (2022). Effect of Socratic Reflection Prompts via videobased learning system on elementary school students' critical thinking skills. Computers & Education, 183, 104497.

21. Hußner, I., Lazarides, R., & Symes, W. (2024). The relation between self-efficacy and teaching behaviour: A video-based analysis of student teachers. Learning and Instruction, 91, 101880.

22. Karim, R. A., Adnan, A. H. M., Salim, M. S. A. M., Kamarudin, S., & Zaidi, A. (2020). Education innovations through mobile learning technologies for the Industry 4.0 readiness of tertiary students in Malaysia. IOP Conf. Ser.: Mater. Sci. Eng., 917, 012022.

23. Karim, R. A., Adnan, A. H. M., Tahir, M. H. M., Adam, M. H. M., Idris, N., & Ismail, I. (2020). The application of mobile learning technologies at Malaysian universities through mind mapping apps for augmenting writing performance. Adv. Sci. Technol. Eng. Syst. Journal, 5(3), 510-517, 2020.

24. Ketelhut, D. J., & Schifter, C. C. (2011). Teachers and game-based learning: Improving understanding of how to increase efficacy of adoption. Computers & Education, 56(2), 539-546.

25. Major, L., & Watson, S. (2018). Using video to support in-service teacher professional development: The state of the field, limitations and possibilities. Technology, Pedagogy and Education, 27(1), 49-68.

26. McTighe, J., & Ferrara, S. (2021). Assessing student learning by design: Principles and practices for teachers and school leaders. Teachers College Press.

27. Meng, X. H., Xu, X. Y., Chen, H. L., & Zhang, L. (2022). The effectiveness of combining e-learning, peer teaching, and flipped classroom for delivering a physiology laboratory course to nursing students. Advances in Physiology Education, 46(1), 21-26.

28. Mercier, E. M., & Higgins, S. E. (2013). Collaborative learning with multi-touch technology: Developing adaptive expertise. Learning and Instruction, 25, 13-23.

29. Mistretta, S. (Ed.). (2024). Reimagining Education: The Role of E-Learning, Creativity, and Technology in the Post-Pandemic Era. IntechOpen.

30. Mistry, M. (2022). Key challenges in primary education. In Contemporary Issues in Primary Education (pp. 5-72). Routledge.

31. Mohd Adnan, A. H. (2020). Immersion, exposure and learner driven learning through 360-degree videos and VR experiences: Education 4.0 for English Teaching. International Journal of e-Learning and Higher Education, 12(1), 61-82.

32. Mohd Adnan, A. H. (2025a). Enhancing University Students' English Presentation Skills with Outdoor Video Tasks. International Journal of Research and Innovation in Social Science, 9(10), 8753-8766.

33. Mohd Adnan, A. H. (2025b). Teaching Arabic as a Third Language with Higher Education 5.0 Technologies. International Journal of Research and Innovation in Social Science, 9(10), 3868-3882.

34. Mohd Adnan, A. H. (2025c). Video-based Learning for Higher Education 5.0 exposure and immersion. International Journal of Research and Innovation in Social Science, 9(10), 4784-4798.

35. Mohd Kamal, M. A., Adnan, A. H. M., Mustafa Kamal, N. N., Ahmad, M. K., & Yusof, A. A. (2019). 60 seconds 'Video-based Learning' to facilitate Flipped Classrooms and Blended Learning at a Malaysian university. In MNNF Network (Ed.), Proceedings of the International Invention, Innovative & Creative (InIIC) Conference, Series 1/2019 (pp. 118-127). MNNF Network.

36. Mustafa Kamal, N. N., Adnan, A. H. M., Yusof, A. A., Ahmad, M. K., & Mohd Kamal, M. A. (2019). 'Immersive Interactive Educational Experiences' – adopting Education 5.0, Industry 4.0 learning technologies for Malaysian universities. In MNNF Network (Ed.), Proceedings of the International Invention, Innovative & Creative (InIIC) Conference, Series 1/2019 (pp. 190-196). MNNF Network.

37. Nickl, M., Huber, S. A., Sommerhoff, D., Codreanu, E., Ufer, S., & Seidel, T. (2022). Video-based simulations in teacher education: the role of learner characteristics as capacities for positive learning experiences and high performance. International Journal of Educational Technology in Higher Education, 19(1), 45.

38. Omar, B. (2025). Effective audio and video-based learning for the youngest age. AURUM Journal of Engineering Systems and Architecture, 9(1), 63-71.

39. Owston, R. (2007). Contextual factors that sustain innovative pedagogical practice using technology: An international study. Journal of Educational Change, 8(1), 61-77.

40. Pegrum, M., Hockly, N., & Dudeney, G. (2022). Digital Literacies. Routledge.

41. Peter, D., Peter, M., & Peter, P. (2025). Advancing Education 4.0 Through Leveraging Digital Technologies: An Empirical Evidence from Secondary Schools in Malaysia. Borneo Engineering & Advanced Multidisciplinary International Journal, 4(1), 14-23.

42. Qamar, M. T., Yasmeen, J., Sohail, S. S., Madsen, D. Ø., Zeeshan, S. M., & Zahid, M. (2025). Laughing while learning: ESP learners' perspectives on teachers' use of humour in online classrooms. Discover Education, 4(1), 321.

43. Ramos, J. L., Cattaneo, A. A., de Jong, F. P., & Espadeiro, R. G. (2022). Pedagogical models for the facilitation of teacher professional development via video-supported collaborative learning. A review of the state of the art. Journal of Research on Technology in Education, 54(5), 695-718.

44. Sablić, M., Mirosavljević, A., & Škugor, A. (2021). Video-based learning (VBL) - past, present and future: An overview of the research published from 2008 to 2019. Technology, Knowledge and Learning, 26(4), 1061-1077.

45. Shah, D. S. M., Adnan, A. H. M., Salim, M. S. A. M., & Salim, M. N. F. M. (2025). Deploying Educational Chatbots as Virtual Assistants for Language Teaching and Learning in Malaysian Tertiary Education. Journal of Advanced Research in Computing and Applications, 39(1), 206-211.

46. Shih, R. C. (2010). Blended learning using video-based blogs: Public speaking for English as a second language student. Australasian Journal of Educational Technology, 26(6), 883-897.

47. Snoeyink, R. (2010). Using video self-analysis to improve the "withitness" of student teachers. Journal of Computing in Teacher Education, 26(3), 101-110.

48. Tembrevilla, G., & Milner-Bolotin, M. (2025). Expanding Teacher's technological, pedagogical, and content knowledge with funds of knowledge: An exploratory STEM professional development model using video creation workshops. Future in Educational Research, 3(1), 127-145.

49. Torrington, J., & Bower, M. (2021). Teacher-created video instruction in the elementary classroom - Its impact on students and teachers. Journal of Computer Assisted Learning, 37(4), 1107-1126.

50. Yousef, A. M. F., Chatti, M. A., & Schroeder, U. (2014). The state of video-based learning: A review and future perspectives. Int. J. Adv. Life Sci, 6(3/4), 122-135.

51. Yusof, A. A., Adnan, A. H. M., Mustafa Kamal, N. N., Mohd Kamal, M. A., & Ahmad, M. K. (2019). Education 4.0 immersive learning with Spherical Videos (360°) and Virtual Reality (VR) experiences. Paper presented at the International Invention, Innovative & Creative Conference (InIIC Series 2/2019), Kuala Lumpur, Malaysia.