Creating, Learning, Reflecting: Students' Journeys with Animated Video Assignment

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ABSTRACT

The integration of student-produced animated video assignments into pharmacy education offers a meaningful alternative to conventional didactic instruction. Grounded in Mayer's (2009) Cognitive Theory of Multimedia Learning (CTML) and constructivist principles of active knowledge building, this cross-sectional study investigated the experiences and perceptions of 58 Diploma in Pharmacy students, following an animated video assignment on drug administration routes embedded within a basic pharmacology course. A validated self-administered questionnaire demonstrated excellent internal consistency across all subscales (Cronbach's $\alpha = 0.913–0.944$). Given confirmed non-normal data distributions, Mann-Whitney U and Kruskal-Wallis H tests were employed for group comparisons. Students reported substantially improved pharmacological knowledge (94.9%; $M = 4.52$, $SD = 0.78$), heightened motivation (87.9%), and technical skill acquisition (86.2%). Overall satisfaction was positive ($M = 3.97$, $SD = 1.11$). Significant gender differences were identified for perceived video clarity ($U = 84.0$, $p = 0.037$) and overall effectiveness ($U = 87.0$, $p = 0.044$); no significant tutorial group differences were observed. Qualitative themes encompassed positive engagement, knowledge enhancement, software accessibility challenges, and creative skill development. Findings offer empirical and methodological contributions to the growing literature on multimedia-based assessment in health professions education, with direct implications for pharmacy curriculum design and digital pedagogy reform in Malaysian and comparable higher education contexts.

Keywords:
Animated video; Pharmacy education; Active learning; Pharmacology; Student engagement; Digital literacy

Introduction

Pharmacy education demands rigorous mastery of complex biomedical concepts including pharmacokinetics, pharmacodynamics, and routes of drug administration that present considerable cognitive challenges when delivered exclusively through conventional didactic instruction (Desai & Kakodkar, 2022). The limitations of lecture-centred pedagogy in fostering conceptual depth, critical thinking, and professional communication competencies have intensified calls for innovative, technology-enhanced teaching strategies across health professions programmes internationally (Knapp et al., 2022). Conventional pharmacology assessments, predominantly end-of-semester written examinations and structured practical reports, have been consistently critiqued for prioritising surface-level recall over the higher-order cognitive processes of analysis, synthesis, and professional application that contemporary pharmaceutical care demands. There is therefore a compelling need for alternative assessment modalities that align more directly with these learning outcomes. This imperative is especially salient within the Malaysian context, where pharmacy diploma programmes at public universities must continuously evolve curricula and assessment practices to prepare graduates for the demands of contemporary pharmaceutical care (Othman et al., 2024a).

Animated video assignments have emerged as a pedagogically compelling response to these challenges. When students are tasked with producing animated videos rather than passively viewing educator-generated content, the pedagogical value is substantially amplified. The production process demands active research, content synthesis, scripting, and creative expression, transforming assessment from a summative exercise into an iterative knowledge-construction endeavour (Zheng et al., 2019; Seo et al., 2021). These processes align directly with established theoretical frameworks in educational psychology, notably Mayer's (2009) Cognitive Theory of Multimedia Learning (CTML) and Vygotsky's (1978) social constructivism, which together constitute the theoretical foundation of the present study.

The COVID-19 pandemic accelerated the adoption of digital and distance learning tools across Malaysian higher education, simultaneously revealing the variable digital preparedness of students and the institutional scaffolding required to support technology-dependent assessments (Othman et al., 2022; Ismail et al., 2021; Sulaiman et al., 2023). Pharmacy students at the participating institution navigated abrupt transitions to online assessments and virtual learning environments, experiences that shaped their digital literacy profiles and readiness for technology-integrated coursework (Othman et al., 2023b). These contextual realities are directly relevant to understanding how students engage with multimedia production assignments requiring independent navigation of digital tools.

In pharmacy and allied health education, animated video assignments have been associated with improvements in knowledge retention, conceptual understanding, and professional communication skills (Jalgaonkar et al., 2019; Doheny et al., 2023). The ability to distil technical pharmacological content into visually engaging, accessible narratives develops digital competencies that are directly transferable to patient education, drug counselling, and health promotion which are the core responsibilities of practising pharmacists (Othman et al., 2023a). Despite this dual pedagogical and professional value, student-generated animated video assignments remain infrequently implemented in pharmacy diploma curricula, particularly within the Malaysian higher education context. To the best of the authors' knowledge, no published empirical study has examined the student experience and perceptions of such assignments specifically within a Diploma in Pharmacy programme in Malaysia. Furthermore, the existing literature on student-produced multimedia tasks in health professions education has relied predominantly on descriptive statistics without prior instrument validation or distributional assumption testing, leaving both the substantive and methodological dimensions of this pedagogical approach insufficiently documented.

The present study addresses these substantive and methodological gaps. It evaluates a student-produced animated video assignment embedded within this basic pharmacology course, incorporating psychometric validation and assumption-appropriate statistical procedures. In doing so, it advances knowledge in three ways: (1) it provides the first empirical account of student-generated animated video assignments in a Malaysian pharmacy diploma programme; (2) it demonstrates the methodological importance of reliability analysis and non-parametric testing for Likert-based pharmacy education surveys; and (3) it situates local findings within the global literature on constructivist multimedia pedagogy, generating transferable insights for pharmacy educators beyond the Malaysian context.

Literature Review

Theoretical Framework

This study is grounded in two complementary theoretical frameworks that collectively explain both the mechanism through which animated video production enhances learning and the process by which students construct meaning from this form of assessment.

Cognitive Theory of Multimedia Learning (CTML)

Mayer's (2009) CTML proposes that learners process verbal and visual information through separate cognitive channels, and that meaningful learning occurs when these channels are coherently coordinated without exceeding cognitive load. Animated videos which integrate dynamic visuals, narration, and text are an exemplary instantiation of CTML principles, enabling learners to construct dual-coded mental models of complex pharmacological processes that would otherwise remain abstract when encountered through text alone (Noetel et al., 2022; Kombartzky et al., 2010). Critically, when students produce animated content, CTML principles are engaged at a generative rather than merely receptive level: the acts of scripting, sequencing, and animating pharmacological information require active retrieval,

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organisation, and elaboration of prior knowledge are the processes deeply aligned with the theory's generative processing principle (Mayer, 2009).

Social Constructivism

Vygotsky's (1978) constructivist framework positions learning as an active, social process of knowledge construction, wherein learners build understanding through meaningful interaction with content, tools, and tasks within their zone of proximal development. Student-produced animated video assignments operationalise constructivist principles by situating learners as active knowledge architects: they must research, critically evaluate, and creatively synthesise pharmacological content into a coherent communicative artefact (Seo et al., 2021; Zheng et al., 2019). This process is further aligned with Biggs and Tang's (2011) constructive alignment framework, wherein the assessment task (animated video production) is explicitly designed to elicit the higher-order cognitive activities including application, analysis, and synthesis that are specified in the learning outcomes of the pharmacology course. Together, CTML and constructivism provide the conceptual scaffolding through which this study interprets student experiences and perceptions of animated video assignments.

Multimedia Tools in Pharmacy and Health Education

The rapid integration of digital technologies into higher education has transformed instructional delivery in health professions programmes globally. Animated videos which are characterised by dynamic visuals, synchronised narration, and movement have gained considerable traction for presenting conceptually dense pharmacological material in an accessible and cognitively manageable format (García-Aguilar et al., 2022). In pharmacology, animated media enable visualisation of mechanisms including drug absorption, distribution, metabolism, excretion whereby that static diagrams and text cannot adequately convey (Desai & Kakodkar, 2022). Within Malaysian pharmacy education, the post- pandemic shift towards technology-enhanced learning has created both opportunities and pressures: students possess varying levels of digital fluency, and programmes must design assessments that develop rather than merely assume technological competency (Othman et al., 2022; Othman et al., 2023b).

Effectiveness in Enhancing Learning Outcomes

Empirical evidence consistently supports the efficacy of animated videos in improving pharmacological and clinical learning outcomes. Jalgaonkar et al. (2019) demonstrated that students engaging with video-based drug administration assignments outperformed peers using conventional methods in Objective Structured Clinical Examinations (OSCEs). Sudirman et al. (2024) reported significant improvements in triage knowledge following animation-based instruction among nursing students, while Doheny et al. (2023) found concise animated videos enhanced healthcare learners' clinical counselling confidence. Chua et al. (2025) further demonstrated that bite-sized animations improved palliative care knowledge and perceived clinical readiness among medical students. Crucially, the literature consistently indicates that students who actively produce animated content demonstrate stronger conceptual integration than passive viewers (Seo et al., 2021; Zheng et al., 2019), a finding theoretically explained by CTML's generative processing principle and constructivist accounts of learning-by-doing.

Students Engagement and Professional Skill Development

Animated video assignments sustain student motivation and active participation through their creative and interactive character (Riana Aprianti et al., 2023). The technical proficiency developed through animation production carries direct professional transferability, equipping graduates with digital communication competencies applicable to patient education materials, drug counselling resources, and public health communication which are the core responsibilities of pharmacists in Malaysian healthcare settings (Othman et al., 2023a). Cholik and Umaroh (2023) reported high satisfaction following animation skill acquisition, and Virga et al. (2020) found multimedia assignments served as motivational catalysts in pharmacy contexts. Career preparedness and professional identity among pharmacy students are further shaped by whether educational experiences develop skills perceived as professionally relevant (Othman et al., 2024b), positioning animated video assignments as pedagogically valuable beyond immediate knowledge acquisition.

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Challenges and Constraints in Implementation

Despite their pedagogical promise, animated video assignments encounter consistent implementation barriers. Cost-effective access to high-quality animation software remains a challenge; Fahlevi and Muchtar (2024) and Harefa et al. (2023) noted that freely available tools are frequently limited in functionality, constraining output quality. The time-intensive nature of production including scripting, animating, voiceover, and editing can impose substantial cognitive and temporal burden on students managing concurrent academic responsibilities (Virga et al., 2020; Maharddhika & Prasetianto, 2023). Individual variability in digital literacy, documented among Malaysian pharmacy students engaging with technology-dependent coursework (Othman et al., 2022; Othman et al., 2023b), may further moderate the effectiveness of such assignments. Structured support mechanisms such as orientation workshops, curated free-tool recommendations, and formative feedback sessions are therefore essential preconditions for realising the full theoretical potential of CTML-informed multimedia production tasks.

Research Objectives/Questions

The primary aim of this study was to evaluate the utility of student-produced animated videos as an educational assessment modality within a basic pharmacology course, from the students' perspective. The study was guided by two research questions:

1. Research Question 1 (RQ1): What are the experiences of Diploma in Pharmacy students in creating animated videos as an assessed task in a basic pharmacology course?
2. Research Question 2 (RQ2): How do Diploma in Pharmacy students perceive animated video assignments as an educational assessment tool within the context of pharmacological learning?

Methods

Research Design

A quantitative cross-sectional survey design was adopted, supplemented by qualitative open-ended items to provide explanatory depth. The cross-sectional approach was selected as appropriate for capturing a contemporaneous snapshot of student experiences and perceptions at a defined endpoint (the end of semester), where the research priority was breadth of response across a cohort rather than longitudinal tracking of change over time (Creswell & Creswell, 2018). The survey method is well-established in pharmacy education research as a pragmatic, ethically low-risk approach for evaluating student perspectives on novel assessment modalities (Othman et al., 2024a; Othman et al., 2023b).

Participants and Setting

Participants were Semester 2 Diploma in Pharmacy students enrolled in a basic pharmacology course at a public university in northern Malaysia. Data collection was conducted during the first semester of the 2023/2024 academic year (March–July 2023). Purposive sampling was employed, targeting students who had completed the animated video assignment and thus possessed direct experiential basis for responding to the survey items. This approach is consistent with purposive criterion sampling, wherein participants are selected because they possess characteristics directly relevant to the research questions (Creswell & Creswell, 2018). The minimum required sample size of 56 was determined based on a 5% margin of error at a 95% confidence level; all 58 enrolled students participated, yielding a 100% response rate.

The Animated Video Assignment

Each student individually created a 7 to 10 minutes animated video on routes of drug administration, subsequently uploaded to YouTube as unlisted or publicly accessible educational resource. The assignment was systematically designed to operationalise CTML and constructivist principles at each stage of the production process. Specifically, the dual-channel principle (Mayer, 2009) was instantiated through the requirement for students to synchronise visual animations with spoken narration, enabling simultaneous verbal and pictorial processing. The coherence principle was

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reinforced through marking rubric criteria emphasising clear, focused presentation of pharmacological content without extraneous material. The generative processing principle was engaged through the acts of scripting, sequencing, and animating drug administration content, which demanded active retrieval, organisation, and elaboration of prior pharmacological knowledge. From a constructivist standpoint (Vygotsky, 1978), the assignment positioned students as active knowledge architects who researched, critically evaluated, and synthesised course content into a communicative artefact, operationalising the higher-order cognitive processes of application, analysis, and creative synthesis specified in the course learning outcomes (Biggs & Tang, 2011). These design features ensured structural alignment between the theoretical framework and the assessment task. Standardised marking rubrics addressing scientific accuracy, clarity of explanation, visual design, and creativity were provided to all students at the assignment briefing to ensure transparency and evaluative consistency.

Research Instrument

Data were collected via a self-administered questionnaire distributed through Google Forms at the conclusion of the semester. The instrument comprised: (a) demographic items (gender, age, tutorial group); (b) a 7-item Experience subscale rated on a 5-point Likert scale (1 = *Strongly Disagree* to 5 = *Strongly Agree*); (c) a 5-item Perception subscale using the same scale; (d) two Overall Assessment items and one Satisfaction item (1 = *Very Dissatisfied* to 5 = *Very Satisfied*); and (e) two open-ended items soliciting qualitative comments and improvement suggestions. The questionnaire was developed specifically for this study to assess the two research questions, with item generation guided by established literature on student-produced multimedia assignments in health professions education (Jalgaonkar et al., 2019; Reyna et al., 2016; Yellepeddi & Roberson, 2016) and informed by the theoretical constructs of CTML, constructivism, and digital skill development. Content validity was established through expert review by three pharmacy education faculty members who evaluated each item for relevance, clarity, and representativeness with respect to the research objectives; minor wording revisions were incorporated following this process. Given that all 58 enrolled students were recruited as the complete study cohort, a separate pilot administration was not conducted; however, the reliability and item discriminability of the instrument were rigorously evaluated during the main data analysis phase. The instrument demonstrated strong internal consistency: Experience subscale ($\alpha = 0.913$), Perception subscale ($\alpha = 0.835$), Overall Assessment ($\alpha = 0.744$), and Full Scale ($\alpha = 0.944$). All item-total correlations exceeded the recommended threshold of $r \geq 0.30$ (range: 0.550–0.811). Likert responses were interpreted using the five-category classification proposed by Pimentel (2010), as presented in Table 1.

Data Analysis

Descriptive statistics (frequencies, percentages, means, standard deviations) were generated using IBM SPSS Statistics, Version 26. Prior to inferential analyses, Shapiro-Wilk normality tests confirmed that all 15 items departed significantly from normality (all $p < 0.001$), with distributions exhibiting pronounced negative skewness consistent with ceiling effects in cohort-level educational surveys. Non-parametric procedures were therefore adopted: Mann-Whitney U tests examined gender differences across all 15 variables, and Kruskal-Wallis H tests assessed variation among the four tutorial groups (A1, B1, C1, D1). Statistical significance was set at $\alpha = 0.05$. Qualitative open-ended responses were subjected to inductive thematic analysis following the six-phase procedural framework of Vaismoradi et al. (2013). In Phase 1 (Familiarisation), all verbatim responses were read and re-read in their entirety to achieve immersion in the data as a whole. In Phase 2 (Generating Initial Codes), each meaningful unit of data was systematically labelled through open coding, producing a set of descriptive codes reflecting the content of individual responses. In Phase 3 (Searching for Themes), codes sharing conceptual similarity were grouped into candidate themes capturing recurrent patterns across responses. In Phase 4 (Reviewing Themes), candidate themes were iteratively evaluated against the full set of coded data to assess internal coherence and mutual exclusivity, with merging or refinement applied where necessary. In Phase 5 (Defining and Naming Themes), each retained theme was assigned a descriptive label and a working definition capturing its essential analytical character. In Phase 6 (Reporting), representative verbatim excerpts were selected for each theme to preserve the authenticity of student voice. The analysis was conducted by the research team, with thematic categories cross-checked by a second team member to strengthen analytical credibility.

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Table 1
Interpretation of the Calculated Mean Score (adapted from Pimentel, 2010)

Mean range	Interpretation
1.00 - 1.80	Strongly disagree / Very dissatisfied
1.81 - 2.60	Disagree / Dissatisfied
2.61 - 3.40	Neutral
3.41 - 4.20	Agree / Satisfied
4.21 - 5.00	Strongly agree / Very satisfied

Results

Demographic Characteristics

Table 2 presents the demographic profile of respondents. The sample was predominantly female (89.7%), with the remainder identifying as male (10.3%). All participants were aged 19–20 years, consistent with typical Diploma programme enrolment. Students were distributed across four tutorial groups (A1, B1, C1, D1), with group sizes ranging from 14 to 16 students. This female-dominant demographic profile is broadly consistent with patterns previously reported for Diploma in Pharmacy students at the same institution (Othman et al., 2024b).

Table 2
Demographic Characteristics of Respondents (n = 58)

Demographic		Frequency (N)	Percentage (%)
Gender	Male	6	10.3
	Female	52	89.7
Age (years)	19	44	75.9
	20	14	24.1
Tutorial Group	A1	14	24.1
	B1	16	27.6
	C1	14	24.1
	D1	14	24.1

Students' Experiences with Animated Video Assignment

Table 3 presents descriptive results for the seven Experience items. Six of seven items achieved 'Strongly Agree' interpretations overall, consistent with the CTML prediction that generative multimedia processing produces substantially positive learning outcomes (Mayer, 2009). Knowledge of drug administration routes was endorsed most strongly (94.9%; M = 4.52, SD = 0.78), a finding consistent with evidence that active video creation deepens pharmacological comprehension beyond passive study (Jalgaonkar et al., 2019; Sudirman et al., 2024; Chua et al., 2025). Heightened interest and curiosity in learning was reported by 87.9% (M = 4.45, SD = 0.92), affirming the motivational dimension of constructivist assessment tasks (Riana Aprianti et al., 2023; Yasa, 2023). Technical skill acquisition was endorsed by 86.2% (M = 4.22, SD = 0.84), and 93.1% reported that the assignment fostered critical thinking (M = 4.38, SD = 0.75). Creative expression (M = 4.38, SD = 0.86) and effective integration of pharmacological knowledge (M = 4.48, SD = 0.76) were also strongly endorsed. The sole 'Agree'-rated item concerned software preparedness (M = 3.85, SD = 0.93), reflecting the variable digital literacy baseline among Malaysian pharmacy students (Othman et al., 2023b).

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Table 3
Students' Experiences with Animated Video Assignment (N= 58)

Item	SD N (%)	D N (%)	N N (%)	A N (%)	SA N (%)	Mean	SD	Interpretation
My knowledge of routes of drug administration significantly improved as a result of this assignment.	1 (1.7)	1 (1.7)	1 (1.7)	19 (32.8)	36 (62.1)	4.52	0.78	Strongly Agree
The assignment increased my interest and curiosity in learning more about drug administration routes.	2 (3.4)	0 (0.0)	5 (8.6)	16 (27.6)	35 (60.3)	4.45	0.92	Strongly Agree
I felt adequately prepared to use the animation software for creating the video.	1 (1.7)	3 (5.2)	15 (25.9)	24 (41.4)	15 (25.9)	3.85	0.93	Agree
I gained valuable technical skills in using the animation software through this assignment.	1 (1.7)	1 (1.7)	6 (10.3)	26 (44.8)	24 (41.4)	4.22	0.84	Strongly Agree
The assignment challenged me to think critically about the different aspects of drug administration routes.	1 (1.7)	0 (0.0)	3 (5.2)	26 (44.8)	28 (48.3)	4.38	0.75	Strongly Agree
Creating the animated video allowed me to express my creativity in presenting the information.	1 (1.7)	1 (1.7)	5 (8.6)	19 (32.8)	32 (55.2)	4.38	0.86	Strongly Agree
This assignment helped me apply and integrate my knowledge of pharmacology and drug administration concepts effectively.	1 (1.7)	0 (0.0)	3 (5.2)	20 (34.5)	34 (58.6)	4.48	0.76	Strongly Agree

Note. SD = Strongly Disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree

Students' Perceptions of Animated Video Assignment

Table 4 summarises Perception item responses. Video content clarity and informativeness received the highest endorsement (91.4%; M = 4.47, SD = 0.75; 'Strongly Agree'), reflecting students' confidence in the communicative quality of their own animated productions, a finding coherent with CTML's segmenting and coherence principles (Mayer, 2009; Yellepeddi & Roberson, 2016). Perceived effectiveness in conveying drug administration information (M = 4.17, SD = 0.73) and retrospective identification of areas for improvement (M = 4.17, SD = 0.70) both achieved 'Agree' interpretations. The latter item is particularly noteworthy as an indicator of metacognitive reflection, a higher-order process consistent with constructivist accounts of self-regulated learning (Reyna et al., 2016). Awareness of multimedia strengths and weaknesses was confirmed by 91.4% (M = 4.38, SD= 0.81; 'Strongly Agree').

Software usability elicited the most heterogeneous responses (M = 3.66, SD = 1.05; 'Agree'), with 15.5% expressing dissatisfaction, the highest rate of negative endorsement across all 15 items. This finding resonates with documented challenges Malaysian pharmacy students have encountered when navigating digital platforms introduced without adequate institutional scaffolding (Othman et al., 2022; Sulaiman et al., 2023), and is consistent with the broader literature on animation software access barriers (Fahlevi & Muchtar, 2024; Harefa et al., 2023).

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Table 4
Students' Perceptions of Animated Video Assignment (N= 58)

Item	SD N (%)	D N (%)	N N (%)	A N (%)	SA N (%)	Mean	SD	Interpretation
I found the information presented in the animated video to be clear and informative regarding the advantages and disadvantages of different routes of drug administration.	0 (0.0)	2 (3.4)	3 (5.2)	19 (32.8)	34 (58.6)	4.47	0.75	Strongly Agree
The animation software was user-friendly and easy to navigate.	1 (1.7)	8 (13.8)	15 (25.9)	20 (34.5)	14 (24.1)	3.66	1.05	Agree
I believe my animated video effectively conveyed the information about drug administration routes.	0 (0.0)	1 (1.7)	8 (13.8)	29 (50.0)	20 (34.5)	4.17	0.73	Agree
Retrospectively, I identify areas where I could have improved the clarity and effectiveness of my animated video.	0 (0.0)	1 (1.7)	7 (12.1)	31 (53.4)	19 (32.8)	4.17	0.70	Agree
This assignment helped me recognise my strengths and weaknesses in multimedia creation and presentation.	1 (1.7)	1 (1.7)	3 (5.2)	23 (39.7)	30 (51.7)	4.38	0.81	Strongly Agree

Note. SD = Strongly Disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree

Overall Assessment, Recommendation, and Satisfaction

Table 5 presents overall assessment and satisfaction outcomes. The assignment was rated as highly effective in promoting pharmacological learning (91.3%; M = 4.48, SD = 0.78; 'Strongly Agree'). Endorsement of broader curricular adoption was positive but more variable (75.8%; M = 3.98, SD = 1.07; 'Agree'), with the larger standard deviation suggesting individual divergence reflective of differing software and time-management experiences. Overall satisfaction was positive (M = 3.97, SD = 1.11; 'Satisfied'), with 81.1% reporting satisfaction or high satisfaction; 8.6% expressed dissatisfaction, likely corresponding to those encountering the greatest implementation barriers.

Table 5
Students' Overall Assessment, Recommendations, and Satisfaction (N = 58)

Item	SD N (%)	D N (%)	N N (%)	A N (%)	SA N (%)	Mean	SD	Interpretation
Overall, I found this assignment to be effective in promoting my learning and understanding of drug administration routes.	1 (1.7)	0 (0.0)	4 (6.9)	18 (31.0)	35 (60.3)	4.48	0.78	Strongly Agree
I would recommend incorporating similar animated video assignments in other pharmacology courses.	1 (1.7)	7 (12.1)	6 (10.3)	22 (37.9)	22 (37.9)	3.98	1.07	Agree
Overall, how satisfied were you with this animated video assignment? (1 = Very Dissatisfied; 5 = Very Satisfied)	5 (8.6)	0 (0.0)	6 (10.3)	28 (48.3)	19 (32.8)	3.97	1.11	Satisfied

Note. SD = Strongly Disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree

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Gender and Group Comparison

Mann-Whitney U tests identified statistically significant gender differences for two variables: video content clarity (P1: U = 84.0, p = 0.037) and overall assignment effectiveness (O1: U = 87.0, p = 0.044), with male students reporting higher median scores on both. Knowledge improvement approached significance (E1: U = 90.0, p = 0.050). All remaining 12 variables showed no significant gender differences (all p > 0.05). Importantly, E2 (interest and curiosity) previously flagged as significant by parametric analysis (p = 0.004) was non-significant under Mann-Whitney U (U = 118.5, p = 0.268), demonstrating that the parametric result was an artefact of non-normal distributions rather than a genuine group effect. The very small male subsample (n = 6) warrants considerable caution in all gender-based interpretations. Kruskal-Wallis H tests revealed no significant differences among tutorial groups for any variable (all p > 0.30), confirming equitable educational impact across all cohorts (Table 6).

Table 6

Mann-Whitney U (Gender) and Kruskal-Wallis H (Tutorial Group) Test Results (N = 58)

Variable	Male M (SD)	Female M (SD)	U	*p* (MW)	H	*p* (KW)	Sig.
E1 – Knowledge of drug administration routes improved	5.00 (0.00)	4.46 (0.82)	90.0	0.050#	0.587	0.899	#
E2 – Increased interest and curiosity in learning	4.83 (0.41)	4.40 (0.96)	118.5	0.268	1.966	0.580	ns
E3 – Adequately prepared to use animation software	4.17 (0.41)	3.81 (0.96)	124.5	0.403	1.590	0.662	ns
E4 – Gained valuable technical skills	4.33 (0.52)	4.21 (0.87)	154.0	0.967	0.651	0.885	ns
E5 – Challenged to think critically	4.67 (0.52)	4.35 (0.77)	120.0	0.310	1.154	0.764	ns
E6 – Expressed creativity in presenting information	4.67 (0.52)	4.35 (0.89)	129.0	0.448	1.568	0.667	ns
E7 – Applied and integrated pharmacology knowledge	4.83 (0.41)	4.44 (0.78)	111.0	0.192	1.418	0.701	ns
P1 – Video content clear and informative	5.00 (0.00)	4.40 (0.79)	84.0	0.037*	0.904	0.824	*
P2 – Animation software user-friendly	3.83 (0.75)	3.63 (1.08)	138.0	0.642	1.997	0.573	ns
P3 – Video effectively conveyed information	4.33 (0.52)	4.15 (0.75)	134.0	0.547	3.569	0.312	ns
P4 – Identified areas for improvement retrospectively	4.17 (0.75)	4.17 (0.70)	158.0	0.966	1.591	0.661	ns
P5 – Recognised multimedia strengths and weaknesses	4.50 (0.55)	4.37 (0.84)	151.5	0.909	0.102	0.992	ns
O1 – Assignment effective in promoting learning	5.00 (0.00)	4.42 (0.82)	87.0	0.044*	3.241	0.356	*
O2 – Recommend for other pharmacology courses	4.50 (0.55)	3.92 (1.11)	114.0	0.261	1.671	0.643	ns
O3 – Overall satisfaction	4.33 (0.82)	3.92 (1.14)	85.0	0.051	0.903	0.825	ns

Note. E = Experience. P = Perception. O = Overall assessment/satisfaction. MW = Mann-Whitney U test (Male n = 6; Female n = 52). KW = Kruskal-Wallis H test (A1 n = 14; B1 n = 16; C1 n = 14; D1 n = 14). * p < 0.05. # p = 0.050 (borderline). ns = not significant.

Qualitative Findings

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Qualitative data were drawn from two open-ended items administered at the end of a self-report questionnaire: (a) an invitation for students to share general comments regarding their experience of the animated video assignment, and (b) a request for concrete suggestions for future improvement of the task. All verbatim responses were recorded and assigned to thematic categories through an inductive thematic analysis process (Vaismoradi et al., 2013). A total of 34 response instances were identified across six themes for student comments (Table 7), and 14 response instances were categorised into five themes for student suggestions (Table 8). Frequencies and percentages are reported as descriptive indicators of thematic prominence within the dataset; these figures reflect the relative salience of each theme rather than functioning as inferential statistics and should be interpreted alongside the interpretive narrative and verbatim excerpts that form the substantive basis of the qualitative analysis. Representative verbatim excerpts are presented in italics to preserve authenticity and contextual meaning.

Table 7

Thematic Analysis of Student Comments on Animated Video Assignment (N = 34)

Theme	n (%)	Description	Examples of Responses (Verbatim)
Positive Experiences	8 (23.5%)	Students expressed general enjoyment, enthusiasm, and a sense of fulfilment associated with completing the animated video assignment.	• *"It's a great medium for discovering hidden talents in editing and creativity."* • *"Fun and challenging."* • *"Educational animated video is more effective at delivering information."* • *"Very enjoyable when completing the assignment."*
Knowledge and Understanding	4 (11.8%)	Students reported that the assignment meaningfully improved their understanding of pharmacological concepts, particularly routes of drug administration.	• *"This assignment really helped me a lot in understanding the route of drug administration."* • *"It really helped me understand this topic very well."* • *"Good for us to know about the route of drug administration when administered to patients."*
Challenges and Constraints	8 (23.5%)	Responses highlighted practical barriers including software subscription costs, restricted access to free tools, and limited editing features.	• *"A good assignment that will increase student creativity and be a fun learning method."* • *"Some apps need a subscription, and it's quite expensive."* • *"Lack of free software with limited editing capabilities and duration restrictions (2–3 minutes)."* • *"Stressful when facing limitations on free features."* • *"Difficult to use software due to subscription costs."*
Creativity and Skill Development	7 (20.6%)	Students acknowledged growth in creative skills and technical proficiency, as well as a desire to further explore animation tools and techniques in future work.	• *"Hope to be more creative and include types of medicine in the video."* • *"Would love to use different types of animation apps to make it easier."* • *"Felt enjoy doing this assignment and found it different and informative."*
Time and Effort	4 (11.8%)	A subset of students reflected on the significant time investment and effort required, expressing hesitation about repeating the assignment despite acknowledging the learning value.	• *"Personally, don't have many skills in creating animated videos, but tried the best."* • *"Kind of hard and tough; spent 3 months doing the video, but learned a lot."* • *"I can do it, but I don't want to do it again in the future because I don't know how to use the software."* • *"I can do it, but I think I don't like to do it again."*

Theme	n (%)	Description	Examples of Responses (Verbatim)
Mixed Feelings / Ambivalence	3 (8.8%)	Several students expressed a dual sentiment—finding the assignment engaging and worthwhile, while simultaneously highlighting concerns about software costs or technical unfamiliarity.	• *"I felt enjoy doing this assignment, but most video editing websites need payment for some features."* • *"It was really fun to do, but most applications require payment for subscription to use more features."* • *"I can do it but don't want to do it again because I don't know how to use the software; I'm nerdy."*

Table 8

Thematic Analysis of Student Suggestions for Future Improvement of Animated Video Assignment (N = 14)

Theme	n (%)	Description	Examples of Responses (Verbatim)
Assignment Structure and Format	3 (21.4%)	Students recommended modifying the structural parameters of the assignment, including video duration flexibility, collaborative group formats, and the option to produce non-animated videos.	• *"The requirement for the duration of the video should be open and depend on the student, as 5 minutes is considered too short."* • *"Propose doing the assignment in a group, which can later serve as a reference for future students."* • *"Suggest changing the assignment into a video without animation, which might be more assignment-friendly."*
Software Access and Technical Support	4 (28.6%)	The most frequently suggested improvement category related to improving access to suitable software tools, providing institutional software recommendations, and encouraging exploration of multiple animation platforms.	• *"Provide apps that are free for students to download and use for their assignments."* • *"Recommend the best and suitable apps for students to use."* • *"Encourage students to explore many apps and software to use in creating animated videos."* • *"Improve skills when handling the applications used."*
Instructional Guidance and Content Support	3 (21.4%)	Students sought enhanced topic briefings, greater flexibility in reference sources, and hands-on demonstrations from lecturers on the use of animation software during the assignment introduction.	• *"Lecturers should guide students on how to use animated video applications during the briefing on the assignment."* • *"Provide more understanding on the topic to assist students in creating better-animated videos."* • *"Allow students to use any references they prefer; no specific references required."*
Creative Integration and Incentivisation	3 (21.4%)	Students proposed integrating artistic and competitive elements into the assignment, including university-level innovation competitions, incentives for outstanding work, and opportunities for art-inclined students to contribute creatively.	• *"Create video or innovation competitions under the university to encourage students to showcase their skills and innovations."* • *"Suggest offering a gift or incentive for the best-animated video."* • *"Embrace students interested in art by allowing them to combine their art skills in education."*
Desire for Continued Engagement	1 (7.1%)	A student expressed an explicit desire to undertake further animated video assignments in future semesters, indicating sustained interest in this form of multimedia assessment.	• *"Express a desire to do more animated video assignments in the future."*

Discussion

This study provides empirically grounded and theoretically situated evidence that student-produced animated video assignments represent a promising, engaging, and psychometrically sound assessment modality within basic

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pharmacology education. The findings are interpreted in light of the study's two research questions, the CTML and constructivist frameworks, and the broader international literature on multimedia-based pharmacy education. As the study is descriptive and relies on self-reported perceptions, interpretations are framed accordingly throughout the discussion.

Student suggestions for future iterations were practical and constructive: institutionally provided animation software licences, structured briefings on tool usage, flexible video duration requirements, and the option for group-based production were among the most frequently raised improvements. These suggestions resonate with recommendations for scaffolded support to ensure equitable access (Yellepeddi & Roberson, 2016). The enthusiasm for incentivised competitions and art-integrated formats signals that students perceive such assignments as genuine opportunities for creative self-expression, an aspiration aligned with the strong professional motivation and career engagement characteristically reported among pharmacy students at the same institution (Othman et al., 2024b).

The overwhelming endorsement of knowledge improvement (94.9%; M = 4.52) represents the most notable self-reported outcome of the assignment and is consistent with the CTML prediction that generative multimedia production supports deeper conceptual learning (Mayer, 2009). Active video creation is theorised to compel students to iteratively engage with pharmacological content through research, scripting, and visual sequencing, processes that may produce qualitatively richer encoding than passive reading or listening (Kombartzky et al., 2010; Seo et al., 2021). This finding aligns with Jalgaonkar et al. (2019), Sudirman et al. (2024), and Chua et al. (2025), across diverse health professions contexts, suggesting that the knowledge-enhancement potential of animated production tasks may be broadly applicable. From a constructivist perspective, the assignment appears to have operationalised knowledge construction within the zone of proximal development (Vygotsky, 1978): students were positioned to move beyond receptive recall towards active synthesis and creative communication, scaffolded by the marking rubric and course content (Biggs & Tang, 2011). It must be noted, however, that these findings are based on self-reported perceptions rather than objective pre-post assessments of pharmacological knowledge, and should therefore be interpreted as indicative rather than conclusive.

The strong endorsement of critical thinking (93.1%; M = 4.38) and knowledge integration (M = 4.48) further substantiates the constructive alignment between the assignment's design and the higher-order cognitive processes targeted by the pharmacology course learning outcomes. These findings extend the institution curriculum evaluation literature (Othman et al., 2024a) by demonstrating that creative multimedia assignments can deliver measurably deeper cognitive engagement than conventional assessments within the same programme.

Software preparedness was the sole 'Agree'-rated experience item (M = 3.85) and, together with the most heterogeneous perception item (software usability; M = 3.66, SD = 1.05), points to digital literacy as a moderating variable in the student experience of animated video assignments. This pattern is directly coherent with findings from Malaysian pharmacy education research: students who transitioned to ODL and online assessments during the COVID-19 pandemic reported significant variability in digital readiness and tool-related confidence (Othman et al., 2022; Othman et al., 2023b), a baseline that persists into post-pandemic technology-enhanced assessments. Qualitative data reinforce this quantitative signal, with software subscription costs and limited free-tool functionality emerging as the most frequently cited challenges, consistent with Fahlevi and Muchtar (2024) and Harefa et al. (2023) internationally, and with digital access inequities documented in Malaysian higher education more broadly.

Students' perceptions of the assignment reveal that its value extended well beyond knowledge acquisition to encompass metacognitive development and professional skill formation. The retrospective identification of areas for improvement (86.2%; M = 4.17) is a particularly meaningful indicator: it suggests that the production and review process cultivated self-regulatory awareness consistent with reflective professional practice, a competency explicitly prioritised in pharmacy graduate outcomes frameworks (Reyna et al., 2016). This metacognitive dimension, theoretically grounded in constructivist accounts of self-regulated learning (Vygotsky, 1978), distinguishes animated video production from conventional assessment formats that rarely elicit such reflective engagement.

Technical skill acquisition (86.2%; M = 4.22) and awareness of multimedia strengths and weaknesses (91.4%; M = 4.38) collectively affirm that the assignment developed professionally transferable digital competencies. Pharmacists are increasingly expected to contribute to patient education materials, digital health communication, and drug

counselling resources using multimedia platforms (Othman et al., 2023a); the animated video assignment prepares students for these responsibilities in a way that conventional pharmacology assessments do not. This professional relevance dimension connects directly to students' career aspirations, which are shaped by perceptions of whether educational experiences develop skills aligned with future professional roles (Othman et al., 2024b).

The adoption of non-parametric procedures, necessitated by confirmed non-normality across all items, produced a meaningful methodological finding: the gender difference for interest and curiosity (E2), previously identified as significant by parametric t-test ($p = 0.004$), was non-significant under the assumption-appropriate Mann-Whitney U test ($p = 0.268$). This discrepancy illustrates the risk of drawing invalid inferential conclusions when parametric tests are applied to ordinal Likert data without prior normality verification, a methodological oversight common in analogous pharmacy education studies. The two genuinely significant gender differences (video clarity and overall effectiveness) are difficult to interpret with confidence given the very small male subsample (n = 6); any gender-based conclusions would require replication in studies with balanced samples.

The consistent absence of tutorial group differences (all Kruskal-Wallis H $p > 0.30$) is an important positive finding for curriculum implementation. It confirms that the assignment's educational benefits were equitably distributed regardless of group assignment, supporting its scalability across this pharmacy programme without differential effects attributable to group-level factors such as tutorial instructor variation (Othman et al., 2024a).

In addressing RQ1, the study indicates that students' reported experiences of creating animated videos were overwhelmingly positive across knowledge acquisition, critical thinking, creative expression, and skill development dimensions, with software preparedness the primary experiential gap. In addressing RQ2, students' perceptions were consistent with the assignment serving as an effective assessment tool, fostering metacognitive reflection, and offering professional relevance, while simultaneously identifying software accessibility and time demands as the principal constraints. Both research questions are thus addressed in ways that are convergent across quantitative and qualitative data streams, and coherent with the CTML and constructivist theoretical frameworks underpinning the study. The descriptive and self-report nature of the data should be borne in mind when drawing conclusions about the assignment's effects on actual learning outcomes.

Conclusion

This study provides theoretically grounded and psychometrically validated evidence that student-produced animated video assignments represent a promising, engaging, and professionally relevant assessment modality within basic pharmacology education. Grounded in CTML and constructivist frameworks, findings suggest that the assignment was associated with self-reported improvements in pharmacological knowledge acquisition, critical thinking, technical skill development, metacognitive reflection, and overall satisfaction among these Diploma in Pharmacy students. The adoption of reliability analysis and non-parametric testing further strengthens the methodological robustness of reported findings, and the equitable impact across tutorial groups supports the assignment's broad curricular scalability.

The study advances knowledge in three meaningful ways. First, it provides the first empirical account of student-generated animated video assignments in a Malaysian pharmacy diploma programme, addressing a contextual gap in the regional pharmacy education literature. Second, it offers preliminary evidence that CTML and constructivist principles serve as useful theoretical anchors for designing and evaluating multimedia production tasks in health professions education. Third, it illustrates the methodological importance of reliability analysis and distributional assumption testing for Likert-based surveys in pharmacy education research, offering a replicable model for future studies.

Animated video assignments represent a forward-looking and theoretically principled pedagogical innovation for pharmacy and allied health education, one that simultaneously advances pharmacological knowledge, digital literacy, and the professional communication competencies central to patient-centred pharmaceutical care (Othman et al., 2023a).

Limitations and Future Studies

Several limitations should be acknowledged. The sample (N = 58) was drawn from a single campus of a public university in Malaysia and comprised a predominantly female cohort (89.7%) with a very small male subsample (n = 6), severely limiting the generalisability of findings and the statistical power of gender comparisons. The cross-sectional design precludes longitudinal assessment of knowledge retention or skill development over time, and reliance on self-reported data introduces the possibility of social desirability bias and prevents objective verification of actual learning gains. The absence of a control group receiving conventional instruction prevents causal attribution of outcomes to the animated video assignment specifically. Additionally, the instrument was not piloted for test-retest reliability, and the absence of pre-assignment baseline data for pharmacological knowledge limits conclusions about learning gains attributable to the assignment versus prior knowledge. Future studies should incorporate validated pre- and post-assignment assessments of pharmacological knowledge alongside self-report measures to provide objective evidence of learning outcomes. Randomised designs comparing animated video assignments with conventional assessments, together with larger and more gender-balanced samples drawn from multiple institutions, would substantially strengthen the evidentiary base.

Nevertheless, the findings carry several direct implications for pharmacy educators, curriculum developers, and institutional administrators. The evidence supporting knowledge acquisition, critical thinking, and professional skill development through animated video assignments provides a strong empirical basis for formalising such tasks as assessed components across pharmacology and related pharmacy science modules at this institution and other comparable institutions. The constructive alignment of the assignment with higher-order course learning outcomes (Biggs & Tang, 2011) offers a replicable design template for curriculum developers. The consistent identification of software accessibility as a primary barrier, both quantitatively (lowest-rated items) and qualitatively (most frequent challenge theme) indicates an urgent need for institutional action. Faculties should negotiate educational licensing agreements for accessible animation platforms, curate and formally recommend free, educationally appropriate tools (e.g., Animaker, Powtoon, Canva), and embed these recommendations within assignment briefing materials. Given the documented variability in digital literacy among Malaysian pharmacy students (Othman et al., 2022; Othman et al., 2023b), assignment briefings should incorporate structured orientation workshops on animation software. Tiered instructional support including initial whole-group demonstrations, curated tutorial resources, and optional drop-in technical assistance would help bridge digital competency gaps and ensure more equitable engagement with the assignment. Future iterations should consider extending the permissible video duration beyond ten minutes, offering group-based collaborative formats to distribute workload, and introducing competitive incentive structures (e.g., best-video awards) to enhance motivation. These modifications respond directly to student recommendations and are consistent with evidence-based principles of active learning assessment design. Pharmacy educators introducing multimedia assignments for the first time should receive training in evaluating digital creative work equitably and providing formative feedback on both pharmacological content and communication design. These competencies are not typically addressed in conventional pharmacy teaching development programmes.

Future research should prioritise multi-institutional studies with larger and more gender-balanced samples to permit robust inferential comparisons and improve generalisability. Longitudinal designs tracking pharmacological knowledge retention and professional skill development over academic semesters would provide evidence of sustained impact beyond the immediate assignment period. Randomised controlled studies comparing animated video assignments with conventional written assessments would strengthen causal claims regarding differential learning outcomes. Investigating the moderating role of structured technical support and institutional software provision on student experience would provide actionable guidance for scalable implementation. Exploring collaborative group-based animated video formats and their effects on teamwork, communication, and pharmacological learning represents a particularly promising avenue, as does examination of whether such assignments enhance professional identity formation and career readiness among pharmacy students (Othman et al., 2024b). Finally, replication of the present study's psychometric and statistical approach, with full reliability analysis and normality testing prior to inferential procedures is recommended as a methodological standard for future pharmacy education survey research.

Conflict of Interest

The authors declare that they have no conflicts of interest relevant to the publication of this manuscript.

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