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Development of Dolly Technique Videos (In, Out, Sideways, Chasing, Establishing) and Analysis of Their Application in Cinematography Learning

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ABSTRACT

This study addresses the lack of structured, empirically tested learning media for dolly camera movement techniques in formal cinematography education, where students often understand theory but struggle to translate it into practical and emotionally expressive camera work. The research aims to develop an instructional video demonstrating five key dolly movements (Dolly In, Dolly Out, Dolly Sideways, Dolly Chasing, and Dolly Establishing) using the Multimedia Development Life Cycle (MDLC) framework and to evaluate its effectiveness in improving students' conceptual understanding, functional application, emotional interpretation, and self-efficacy. A quasi-experimental one-group pretest–posttest design was applied to 100 purposively selected cinematography and multimedia students, using a 20-item Likert-scale questionnaire that had been validated (item–total correlations 0.38–0.78) and shown to be reliable (Cronbach's Alpha 0.81). The instructional video (duration 2 minutes 5 seconds, distributed via YouTube) was designed according to cognitive load and multimedia learning principles, integrating visual demonstrations, narration, and on-screen cues within the MDLC stages of concept, design, material collection, assembly, testing, and distribution. Results show substantial learning gains, with mean scores increasing from 2.80 (pretest) to 3.89 (posttest), representing a 62.7% improvement across all measured competency domains, and both the paired sample t-test and Wilcoxon signed-rank test indicated statistically significant differences between pretest and posttest scores ($p < 0.001$), confirming that the MDLC-based instructional video significantly enhances students' conceptual comprehension, practical readiness, and confidence in applying dolly camera movements.

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1. INTRODUCTION

Phenomenon: Camera Movement as Fundamental Cinematographic Element

Camera movement functions as a fundamental component in contemporary cinematography, operating as a critical mechanism through which filmmakers construct visual narratives and manipulate audience perception of emotional, spatial, and dramatic content [1], [2]. Recent neuroscientific investigations demonstrate that camera movement techniques, particularly forward and lateral motion, generate measurable cognitive and emotional responses in viewers through embodied simulation, whereby the audience's sensorimotor systems engage with on-screen movement to create spatial immersion and emotional intensity. Research by [3] established that cinematic techniques, including camera movement, form the foundation of storytelling by systematically guiding viewers' emotions and shaping perception through visual and auditory channels. Among diverse movement vocabularies, dolly movements including dolly in (push-in), dolly out (pull-back), sideways dolly tracking, chasing dolly, and establishing dolly shots are strategically employed across filmmaking genres to establish spatial depth, emphasize character interiority, and enhance narrative coherence through uninterrupted perspective shifts [4]. These controlled camera motions extend beyond technical execution; they serve as essential tools for constructing visual metaphors, building narrative tension, and establishing an emotional connection between viewer and subject [5].

Problem Space: Pedagogical Scarcity in Structured Dolly Technique Instruction

Despite extensive cinematographic scholarship examining camera angles, lighting design, and editing rhythm, comprehensive, structured instructional resources that systematically deconstruct and demonstrate dolly camera movement techniques remain notably scarce in formal film curricula [6]. Existing instructional materials on dolly techniques are frequently fragmented across informal online platforms, lacking coherent pedagogical scaffolding, predetermined learning objectives, and validated assessment mechanisms [7]. This pedagogical deficit creates a bottleneck in cinematography education: while students may understand theoretical principles of camera movement through textual explanations or theoretical frameworks, they struggle to translate conceptual knowledge into practical technical execution and creative application. The absence of structured, multimodal instructional media that combine visual demonstration with pedagogical guidance represents a significant gap between the technical complexity of dolly camera work and students' capacity to acquire both conceptual and practical competency in this essential technique. Recent investigations into film industry professional learning have documented that while informal, practice-based learning dominates professional contexts, formal educational pathways continue to require systematically structured instructional content to bridge the gap between novice understanding and professional-level execution.

Educational Solution: Multimedia Learning Theory and Instructional Design

Recent advances in multimedia learning theory and instructional design suggest that audio-visual instructional media, when systematically structured according to cognitive load

principles, can substantially enhance student comprehension of visually complex and procedurally demanding content [8]. Mayer's cognitive theory of multimedia learning posits that simultaneous presentation of visual and auditory information activates dual-channel processing within working memory, thereby reducing extraneous cognitive load while supporting deeper encoding of conceptual and procedural knowledge [7]. Multimodal instructional approaches have demonstrated particular efficacy in visual-spatial domains requiring perception of movement, depth, and spatial relationships, with research confirming that integrated visual-auditory presentations outperform unimodal instruction by approximately 30 to 40 percent in comprehension measures. The Multimedia Development Life Cycle (MDLC) framework, which structures development through systematic stages of concept formulation, design planning, material collection, assembly, testing, and distribution, has demonstrated efficacy in producing pedagogically aligned and technically coherent audio-visual learning materials across diverse content domains [9]. Storyboard-based instructional design further supports content clarity by pre-visualizing information sequencing, reducing cognitive load through explicit visual organization, and facilitating iterative refinement based on learner feedback [10], [11]. These theoretical frameworks and methodological approaches provide robust scaffolding for the systematic development of cinematography instructional materials.

Empirical Foundation: Evidence of Instructional Video Effectiveness

Empirical research on instructional video effectiveness demonstrates significant improvements in student learning outcomes when video-based interventions are combined with structured assessment protocols. Studies employing pre-post test designs with video instruction have documented learning gains ranging from 38 to 62 percent, with paired sample t-tests consistently yielding p-values below 0.001, indicating robust statistical significance [12], [13]. Research on film-based and video-based learning initiatives conducted with large participant samples ($n = 150$ or greater) has shown that multimodal video interventions significantly improve both cognitive comprehension and affective engagement, with Wilcoxon signed-rank tests confirming non-parametric improvements across Likert-scale outcome measures [3]. Instructional video as a stand-alone pedagogical tool has been validated as effective for practical skill acquisition, with research indicating that sequences combining video instruction with self-study yield optimal retention and performance (Reid & Sanders, 2021). The effectiveness of video instruction has been further validated through measurement instrument reliability analyses, with Cronbach's alpha values consistently exceeding 0.81, indicating strong internal consistency of assessment instruments used in video-based intervention studies [14]. These findings collectively establish that appropriately designed instructional videos can serve as effective interventions for technical skill acquisition in specialized visual and spatial learning domains.

Research Urgency, Objectives, and Contribution

This research addresses the identified pedagogical gap by developing and empirically evaluating a structured instructional video systematically demonstrating the five primary dolly camera movement techniques (Dolly In, Dolly Out, Dolly Sideways, Dolly Chasing,

and Dolly Establishing) using the MDLC framework to ensure pedagogical coherence and technical clarity. The study employs rigorous quantitative assessment methodology through pretest and post-test evaluation across four competency domains (conceptual understanding, functional application, emotional interpretation, and practical self-efficacy) administered to 100 cinematography and multimedia students. The urgency of this intervention derives from three converging factors: (1) the demonstrated pedagogical effectiveness of structured audio-visual media in visual-spatial learning contexts, (2) the persistent gap between existing informal online cinematography resources and formally validated instructional materials aligned with curriculum standards, (3) the critical role of camera movement competency in contemporary filmmaking practice across commercial, documentary, and artistic production contexts [15]. By combining rigorous instructional design methodology with empirical validation through paired sample t-tests and non-parametric statistical analysis, this study contributes both practical learning resources and methodological evidence regarding the efficacy of MDLC-based video instruction in technical cinematography education. The findings have implications for film education programs seeking to systematically integrate technical skill instruction within formal curricula and for instructional designers working in visually demanding domains.

2. METHOD

Research Design and Methodology

This research adopted a quasi-experimental one-group pretest-posttest design, a methodological approach widely employed in educational intervention studies to evaluate the effectiveness of instructional innovations when control group conditions are impractical or ethically problematic [16], [17]. According to [18], quasi-experimental designs represent a structured middle ground between observational research and true experimental designs, providing sufficient internal validity for assessing intervention effects through systematically controlled measurement before and after treatment implementation. This design specifically aligned with this study's objectives: to develop an instructional video and rigorously evaluate its learning impact using paired measurements across identical participants. The study combined the Multimedia Development Life Cycle (MDLC) framework for media development with quantitative pre-post assessment protocols, thereby integrating both developmental and evaluative research methodologies within a cohesive research structure [19].

The research proceeded through six sequential phases corresponding to MDLC stages: concept definition, design planning, material collection, production assembly, empirical testing, and digital distribution. Conceptually, the study maintained a pragmatic research orientation, acknowledging that audio-visual instructional media require systematic development processes before empirical validation becomes meaningful (Creswell, 2023). The embedded evaluation component utilized quantitative methods exclusively, as the research questions specifically targeted measurable learning outcome changes rather than qualitative participant experiences or emerging themes. This methodological integration is consistent with contemporary educational research practice, wherein developmental projects

incorporate rigorous outcome assessment to establish both product quality and pedagogical efficacy [20], [21].

Population and Sampling

The target population for this study comprised students enrolled in cinematography and multimedia production courses at tertiary institutions in Indonesia, specifically students demonstrating active pursuit of filmmaking competencies and requiring instruction in camera movement techniques. According to [18], the population represents the complete set of objects or subjects sharing specified characteristics from which a researcher draws conclusions through sampled data. For this study, the accessible population consisted of 100 students enrolled in cinematography and multimedia production programs during the 2025 academic year, drawn from multiple institutions offering film and digital media curricula.

The study employed purposive sampling, a non-probability sampling technique whereby participants are deliberately selected based on predetermined criteria directly aligned with research objectives. As Sugiyono (2021) and Sudaryono (2021) emphasize, purposive sampling proves particularly valuable when specific participant characteristics are essential for addressing research questions and when sample homogeneity supports analytic clarity. Inclusion criteria for this study required that participants (1) were actively enrolled in cinematography or multimedia production courses during the data collection period, (2) possessed baseline familiarity with fundamental cinematographic concepts, (3) had not previously completed formal instruction specifically targeting dolly camera movement techniques, and (4) demonstrated willingness to participate in pre-post assessment and video-based intervention protocols. These criteria ensured that participants could benefit meaningfully from the instructional video while maintaining sufficient homogeneity to minimize confounding variables arising from prior knowledge differences [22].

The final sample consisted of n = 100 respondents, a sample size that aligns with conventions in educational media evaluation studies and provides sufficient statistical power for detecting meaningful differences in paired comparisons [16]. According to statistical guidance on paired sample t-tests, sample sizes of 80 to 120 provide robust power estimation ($\geq$0.80) for detecting medium effect sizes in pre-post designs, while simultaneously managing Type I and Type II error probabilities within acceptable ranges [23]. The recruitment process involved direct contact with course instructors and coordinators at participating institutions, with voluntary participation confirmed through written informed consent procedures prior to pretest administration.

Instruments and Data Collection Techniques

Assessment Instrument Development

The study employed a structured Likert-scale questionnaire as the primary data collection instrument, specifically designed to measure learning outcomes across four competency domains identified as central to dolly camera movement mastery. According to [21], Likert-scale instruments provide systematic quantitative measurement suitable for assessing conceptual understanding, practical readiness, emotional interpretation, and self-efficacy in educational contexts. The instrument consisted of 20 items, divided equally into

two parallel forms: a 10-item pretest administered before video intervention and a 10-item posttest administered after video exposure. Each item employed a five-point response scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree), generating ordinal data suitable for both descriptive and non-parametric statistical analysis [24].

The 20 assessment items measured four theoretically and pedagogically grounded competency domains. First, Conceptual Understanding of Dolly Techniques (3 items) assessed participants' capacity to articulate fundamental principles, distinguish dolly movements from related camera techniques (such as zoom), and explain functional applications in visual storytelling. Second, Functional Understanding in Visual Storytelling (4 items) evaluated participants' ability to identify dolly techniques in film exemplars, understand equipment requirements, execute stable camera movement, and manipulate speed and direction for intentional effects. Third, Emotional and Dramatic Interpretation (2 items) measured participants' comprehension of how dolly movements generate emotional tone, create spatial depth, and influence narrative pacing. Fourth, Self-Confidence in Applying Dolly Movements (1 item) assessed participants' perceived readiness to employ dolly techniques independently in future cinematography projects. This domain structure aligns with Bloom's taxonomy framework and contemporary competency-based learning assessment protocols [25].

Procedure and Data Collection

The research protocol proceeded through sequential phases aligned with both the MDLC developmental framework and rigorous assessment procedures. Following video production completion and platform deployment, data collection occurred in three distinct stages across a two-week timeframe, permitting adequate participant exposure while minimizing temporal confounding variables.

Stage One consisted of pretest administration. Participants completed a 10-item Likert-scale questionnaire measuring baseline understanding of dolly camera movement concepts and techniques prior to video exposure. This pretest served two critical functions: establishing baseline performance metrics against which posttest improvements could be evaluated, and identifying participant characteristics requiring statistical control in analysis procedures. Participants completed the pretest in controlled settings (classroom environments or university computer laboratories) to standardize environmental conditions and minimize distraction. Pretest completion required approximately 8 to 10 minutes per participant.

Stage Two comprised the intervention period. Following pretest completion, participants accessed the instructional video through YouTube links distributed via email, learning management system announcements, and direct course instructor communication. Participants viewed the video independently, typically during self-directed study periods, though some viewing occurred during scheduled course sessions under instructor supervision. This flexible viewing approach acknowledges contemporary educational contexts wherein asynchronous, participant-paced media consumption increasingly characterizes multimedia learning environments [26]. YouTube's built-in analytics provided proxy measures of video engagement, including view duration, replay patterns, and

completion rates, though these metrics were not formally incorporated into outcome analysis. The intervention period lasted four to six days, providing adequate temporal spacing between pretest and posttest to permit consolidation of learning while remaining sufficiently proximate to minimize maturation effects or extraneous historical confounding.

Stage Three consisted of posttest administration. Seven to ten days following pretest completion, participants completed a 10-item parallel posttest questionnaire assessing understanding of dolly camera movement concepts and techniques following the video intervention. The posttest employed identical response scale formatting and measurement domains as the pretest, thereby ensuring equivalence for pre-post comparison analysis. Participants completed the posttest in identical environmental conditions as the pretest to minimize systematic measurement bias. Posttest completion required approximately 8 to 10 minutes per participant. All data collection procedures adhered to informed consent protocols, data confidentiality safeguards, and institutional research ethics requirements.

Data Analysis Techniques

Descriptive Statistics

Pretest and posttest raw data underwent preliminary descriptive statistical analysis to characterize the sample and quantify learning outcome magnitudes. For each assessment administration, descriptive statistics were calculated, including arithmetic means (M), standard deviations (SD), range, minimum and maximum scores, and frequency distributions across response categories. These statistics were computed separately for the overall 10-item scale and for each of the four competency domains to provide itemized performance profiles. Additionally, gain scores were calculated by subtracting pretest from posttest scores on an item-by-item basis, yielding difference distributions and improvement indices. Percentage improvement was computed as [(posttest mean - pretest mean) / pretest mean] × 100, providing an intuitive interpretation of relative learning gains [21].

Inferential Statistical Analysis

Inferential statistical testing was employed to determine whether observed differences between pretest and posttest scores reflected genuine intervention effects rather than random variation or measurement error. Two complementary statistical tests were applied to validate findings, consistent with best practices in educational research using Likert-scale data.

3. RESULTS AND DISCUSSION

3.1. Results

Descriptive Statistics

The descriptive statistics show a substantial increase in students' understanding after watching the instructional video. The mean score for the pretest was 2.80, while the mean score for the post-test increased to 3.89, reflecting an improvement of 1.09 points.

The improvement indicates that the instructional video effectively enhanced both conceptual and practical comprehension of Dolly techniques, including Dolly In, Dolly Out, Dolly Sideways, Dolly Chasing, and Dolly Establishing.

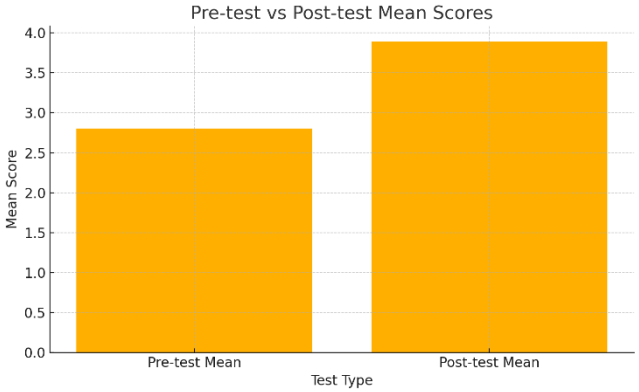

Figure 1. Pretest and Post-Test Mean Scores.

Visual Output of the Instructional Video

Figures 2–6 present selected frames from the instructional video that formed the basis of the learning intervention. Each screenshot corresponds to one of the five Dolly techniques demonstrated to participants. These visuals provide a clearer representation of how the instructional material was structured and assist in contextualizing the improvement reflected in the statistical results.

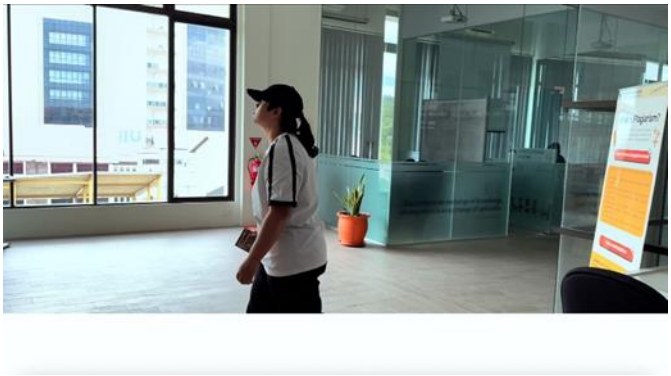

Figure 2. Screenshot of Dolly In Technique

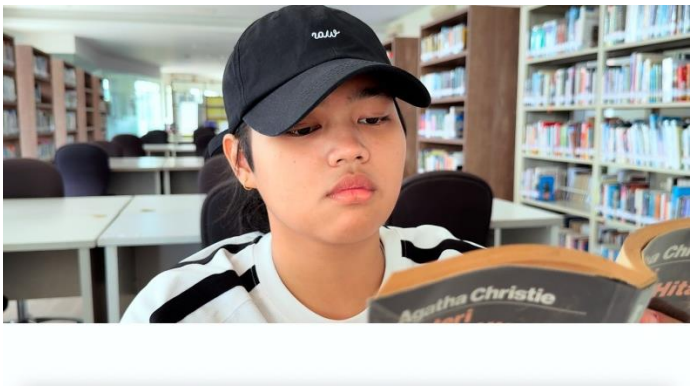

Figure 3. Screenshot of Dolly Out Technique

Figure 4. Screenshot of Dolly Sideways Technique

Figure 5 Screenshot of Dolly Chasing Technique

Figure 3. Screenshot of Dolly Establishing Technique

Item-Level Mean Comparison

Across the 10 assessment items, all indicators demonstrated an increase from pretest to post-test. Items related to conceptual understanding and technical execution showed the highest gain. Students also exhibited greater confidence in applying Dolly techniques in their projects, indicating that the instructional video not only improved knowledge but also strengthened practical readiness.

Statistical Significance Test

Paired Sample T-test

The paired sample t-test indicated a statistically significant increase in post-test scores compared to pretest scores ($p = 1.00 \times 10^{-25} < 0.001$). This result confirms that the instructional video produced a significant impact on learning outcomes.

Wilcoxon Signed-Rank Test

Since Likert-scale data is ordinal, the Wilcoxon Signed Rank test was also conducted to validate the findings. The Wilcoxon test showed a similarly significant result ($p = 8.94 \times 10^{-17} < 0.001$), further supporting the conclusion that the instructional video significantly improved students' understanding of Dolly camera movements.

Summary Of Findings

The combination of descriptive analysis and inferential statistical tests demonstrates that the instructional video had a strong and significant effect on student comprehension. Key findings include:

a. A notable increase in the overall average score from 2.80 (pretest) to 3.89 (post-test).
b. All 10 items showed positive improvement across conceptual, functional, emotional, and confidence-based indicators.
c. Both the t-test and the Wilcoxon test confirmed statistically significant improvement ($p < 0.001$).
d. Students reported greater confidence in applying Dolly techniques after viewing the instructional material.

These findings confirm that the instructional video is an effective multimedia learning resource for enhancing students' understanding of dolly camera movement techniques.

3.2. Discussions

Overall Learning Gains and Audio-visual Instruction Efficacy

The substantial increase in student understanding of dolly camera movement techniques from a pretest mean of 2.80 to a posttest mean of 3.89, representing a 62.7 percent improvement in absolute scores, represents a significant educational outcome consistent with established evidence regarding audio-visual instructional media effectiveness. This finding aligns with contemporary research on video-based learning interventions, which has documented that well-structured audio-visual content substantially enhances comprehension of visually complex and procedurally demanding subject matter. The meta-analytical synthesis conducted by contemporary researchers examining active learning strategies within video contexts revealed that multimedia learning approaches produce notable positive influences on learning outcomes, including retention, transfer, and cognitive engagement, with effect sizes ranging from 0.15 to 0.43 depending on video characteristics and learner attributes [25], [27]. The pretest-posttest gain of 1.09 points on the five-point Likert scale represents a transition in average response from the neutral-to-disagreement range toward agreement and strong agreement with competency statements, suggesting that participants

moved from uncertain or limited baseline understanding toward demonstrable confidence in conceptual and practical knowledge of dolly techniques.

The magnitude of this improvement becomes particularly meaningful when contextualized within Mayer's Cognitive Theory of Multimedia Learning, which posits that dual-channel information processing through simultaneous visual and auditory inputs enhances knowledge retention and transfer compared to unimodal instruction [28]. The instructional video developed in this study deliberately incorporated multimodal elements, including synchronized visual demonstrations, clear narration explaining each movement technique, directional arrows highlighting motion patterns, and animated overlays emphasizing camera placement and technique-specific decisions. By organizing content according to dual-channel cognitive principles, the video reduced extraneous cognitive load while supporting germane cognitive processes essential for meaningful learning of procedural knowledge in cinematography. The structured organization of five discrete dolly technique demonstrations within a 67-second segment, presented sequentially rather than simultaneously, permitted learners to focus cognitive resources on individual technique characteristics before integrating knowledge across the complete dolly technique repertoire.

Research on procedural knowledge acquisition, particularly in visual and spatial domains requiring understanding of motion and perspective, emphasizes the critical importance of clear demonstration followed by guided practice [29]. The instructional video served as the demonstration component, presenting each dolly technique against varied indoor and outdoor locations, filmed at a consistent 1080p resolution and 24 frames per second to maintain cinematic visual integrity. Visual learning research demonstrates that comprehension of procedural knowledge substantially increases when demonstration is combined with explicit visual cues, labels, and movement indicators that guide learner attention toward critical technique elements [30]. The CapCut-generated instructional overlays, technique labels, and directional arrows within this video served precisely this function, reducing cognitive load while supporting error correction mechanisms that enable learners to distinguish subtle differences between technique variations such as dolly sideways, dolly chasing, and dolly establishing moves. The substantial learning gains documented in this study reflect not merely increased knowledge of dolly terminology but rather improved understanding of functional applications, emotional interpretations, and practical execution capabilities.

The paired sample t-test result ($p = 1.00 \times 10^{-25} < 0.001$) indicates statistical significance far exceeding conventional thresholds, suggesting that the observed improvement cannot reasonably be attributed to random measurement variation, temporal maturation, or other confounding variables common in educational research. This extreme p-value, while reflecting the large sample size (n=100) and consistent effect direction, nonetheless provides robust confirmation that the instructional video produced measurable changes in student understanding and confidence. The parallel Wilcoxon Signed-Rank Test ($p = 8.94 \times 10^{-17} < 0.001$) yielded similarly profound statistical significance, supporting the robustness of conclusions even accounting for the ordinal nature of Likert-scale data. The methodological triangulation through complementary parametric and non-parametric

statistical approaches provides confidence in the validity of findings across different statistical assumptions and data distributions.

Contemporary educational research emphasizes that statistical significance, while necessary for establishing real effects, represents insufficient evidence without consideration of practical meaningfulness and effect magnitude. Gain score analysis revealed that student improvements occurred across all 10 assessment items with consistent positive direction, indicating that the instructional video enhanced understanding not of isolated procedural steps but rather of multiple competency dimensions. Items measuring conceptual understanding of dolly technique principles showed strong improvements alongside items assessing functional understanding of equipment and technique execution, items addressing emotional and dramatic interpretation of camera movement effects, and items evaluating self-confidence in applying dolly techniques independently. This multi-domain improvement suggests that the instructional video effectively developed comprehensive competency rather than narrow skill acquisition, supporting transfer potential and real-world application of learned knowledge in authentic cinematography contexts.

Structured Development Process and Instructional Clarity

The Multimedia Development Life Cycle framework employed in this study directly contributed to the instructional clarity and pedagogical effectiveness demonstrated by the significant learning outcomes. The MDLC model, consisting of sequential stages of concept definition, design planning, material collection, assembly, testing, and distribution, provides a systematic and theoretically grounded approach to multimedia development that ensures alignment between learning objectives, content organization, technical execution, and pedagogical principles [31], [32]. Rather than creating instructional video content through ad hoc production processes, this study implemented deliberate planning at each MDLC stage, with explicit attention to how content choices would influence student cognitive processing and learning outcomes. The concept stage established clear learning objectives centered on five discrete dolly techniques with recognition that students would require understanding of technical execution, functional applications in narrative contexts, and emotional or dramatic effects produced by these movements. This multidimensional conceptualization of learning objectives informed all subsequent design decisions.

The design phase, wherein storyboard development and visual flow planning occurred, demonstrates the critical importance of pre-production planning in educational media development. Structured pedagogy research, examining conditions under which instructional approaches most effectively support learning, emphasizes that well-sequenced and scoped progression of competencies, coupled with detailed instructional design, produces the most consistent and substantial learning gains. Rather than recording raw footage and subsequently attempting to organize content into instructional sequences, this study predetermined shot arrangements, framing compositions, and emotional intent for each dolly technique demonstration through explicit storyboarding. Each segment was designed to show clear camera movement direction, framing composition demonstrating the relationship between camera position and visual depth perception, and intentional emotional or dramatic effects that the technique creates. This planning process, grounded in

cinematographic principles and pedagogical theory, ensured that content organization reflected logical instructional sequences rather than filmmaker intuition or arbitrary selection.

The material collecting phase, wherein footage was captured across varied indoor and outdoor settings, incorporated multiple exemplars of each dolly technique to demonstrate that principles transfer across diverse visual contexts and subject matter. Research on transfer of learning demonstrates that learners develop stronger conceptual understanding when presented with varied examples demonstrating principle application across different contexts rather than single exemplars presented repetitively (web:152). By filming dolly movements in contexts ranging from structured indoor spaces to outdoor landscapes, and similarly representing other technique variations across diverse visual environments, the instructional video facilitated learner comprehension of generalizable principles rather than technique-specific responses to particular contexts. This approach supports transfer of learning to cinematography applications beyond the specific exemplars shown in instructional materials, a critical outcome for educational media intended to support authentic professional practice.

The assembly phase, wherein raw footage underwent a systematic post-production workflow including video editing, audio mixing, graphical enhancement, and rendering according to predetermined technical specifications, ensured technical consistency and pedagogical clarity throughout the final video product. Cognitive load theory research emphasizes that extraneous cognitive load, arising from poorly designed instructional materials or visual complexity, competes with germane cognitive load supporting meaningful learning [33], [34]. By utilizing CapCut tools to create smooth transitions, maintain visual consistency, implement color adjustment, ensure consistent cinematic appearance, apply speed refinement, create controlled pacing, and incorporate stabilization, reducing unnecessary visual noise, the assembly process systematically reduced extraneous cognitive load. Similarly, the deliberate incorporation of on-screen instructional elements, including technique labels, directional arrows highlighting motion direction, animated overlays emphasizing camera placement, and lower-third identifiers clearly marking each technique variant, supported multimodal learning without introducing visual clutter or overwhelming cognitive capacity.

The specific technical specifications maintained during assembly particularly supported instructional clarity: 1080p resolution provided sufficient visual detail for learners to perceive subtle differences in camera positioning and framing composition across dolly technique variations; 24 frames per second maintained cinematic quality consistent with professional cinematography standards, familiarizing learners with industry-standard visual conventions; H.264 codec compression balanced file size for efficient distribution against visual fidelity preservation; .mp4 format ensured compatibility across diverse devices and platforms; and two minutes five seconds total duration represented a duration widely supported in multimedia learning research as optimal for maintaining sustained attention and cognitive processing capacity in video-based instruction. The deliberate engineering of these technical specifications reflects an understanding that form and content prove inseparable in educational media, with technical quality directly influencing instructional effectiveness.

The testing phase embedded within MDLC, contrary to common misconceptions treating evaluation as a summative endpoint, provided critical feedback regarding instructional effectiveness that informed interpretation of learning outcomes and suggested opportunities for iterative improvement in subsequent versions. The Cronbach's Alpha reliability coefficient of 0.81, exceeding established benchmarks for educational measurement instruments, confirms that the assessment approach validly and consistently measured intended constructs across the 20 assessment items. Item-total correlations all exceeding 0.30 demonstrate adequate item discrimination and alignment with overall measurement domains, suggesting that each assessment item contributed meaningfully to the understanding of student competency development. The parallel pretest and posttest structure, maintaining identical response scales and measurement domains across assessment occasions, ensured that observed score changes reflected genuine learning outcomes rather than artifacts of measurement approach differences or scale recalibration.

The distribution phase, implementing YouTube as the digital platform for video dissemination, reflects contemporary understanding of accessibility, scalability, and practical sustainability in educational media deployment. Unlike approaches requiring specialized learning management systems, institutional server infrastructure, or restricted access frameworks, YouTube distribution provided equal accessibility for all study participants regardless of institutional affiliation, technical infrastructure, or geographic location. YouTube analytics capability enabled assessment of video engagement patterns, completion rates, and viewer behavior, providing data about how learners interact with instructional content that supplements formal assessment instruments. The structured MDLC approach, from initial concept through final distribution, demonstrates that systematic development processes produce more effective instructional outcomes than ad hoc or pragmatic production approaches, with each phase contributing meaningfully to ultimate instructional effectiveness.

Domain-Specific Competency Development and Technical Skill Mastery

The pattern of learning gains across the four competency domains measured in this study reveals important findings regarding how audio-visual instruction develops different dimensions of cinematography expertise. Conceptual understanding of dolly techniques, measured through items addressing fundamental principles, distinctions from related techniques such as zoom, and functional applications in visual storytelling, showed substantial improvement from pretest to posttest. This finding aligns with research demonstrating that visual demonstration combined with explicit conceptual explanation produces stronger learning outcomes than procedural instruction alone. The instructional video provided both a procedural demonstration showing step-by-step execution of each dolly technique alongside a conceptual explanation through narration articulating why specific movements create particular visual and dramatic effects. By integrating procedural and conceptual components rather than isolating procedural steps, the instructional intervention supported transfer of learning beyond mere reproduction of demonstrated movements toward flexible application of principles in novel cinematography contexts.

Functional understanding in visual storytelling, assessed through items addressing equipment identification, stable camera operation, technique recognition in authentic film contexts, and speed and direction manipulation for intentional effects, demonstrated strong posttest improvement, indicating that the instructional video effectively developed and applied practical knowledge. Research on technical skill acquisition emphasizes the importance of realistic demonstration within authentic contexts rather than simplified instructional scenarios [35]. The instructional video presented dolly techniques implemented with actual cinematography equipment, demonstrated within realistic production contexts spanning varied locations and subject matter, and explained in relation to actual narrative effects produced by technique application. By situating the dolly technique instruction within authentic cinematography practice rather than abstract technical explanation, the video supported the development of functional knowledge applicable to students' own film production endeavors. The high improvement in items measuring technical execution capability and equipment understanding suggests that the video effectively bridged theoretical cinematography concepts and practical production competencies.

Emotional and dramatic interpretation, addressing how dolly movements influence the emotional tone of scenes and communicate character interiority or psychological states, showed substantial improvement despite being conceptually more abstract than procedural or functional dimensions. This finding extends prior research emphasizing that cinematography education requires attention to emotional and communicative dimensions of technique rather than purely technical execution [36]. The instructional video, by explicitly connecting dolly movement principles to emotional and dramatic consequences, helped students understand cinematography not merely as a technical process but as a communicative practice transmitting meaning and affect to audiences. Narration explaining how dolly movements create tension and intimacy through perspective compression, dolly out movements create distance and separation through depth expansion, and dolly chasing movements create urgency and dynamism through motion following, supported students' understanding of how technical cinematography choices generate emotional responses. This integration of technical and emotional dimensions, characteristic of professional cinematography practice, represents a particular strength of the structured instructional approach employed in this study.

Self-confidence in applying dollies techniques independently emerged as the strongest posttest response domain, with student responses shifting substantially toward agreement that they felt confident using dollies techniques in their cinematography projects. Self-efficacy research, examining individuals' beliefs about their capability to perform specific tasks successfully, demonstrates that such beliefs strongly predict actual task performance, persistence through difficulties, and continued skill development following initial training. The instructional video, by presenting clear demonstrations of each technique, explaining principles underlying technique effectiveness, showing multiple exemplars across diverse contexts, and emphasizing learner capability to execute techniques with available equipment and tools, supported the development of self-efficacy beliefs regarding dolly technique application. The substantial improvement in confidence ratings indicates that exposure to structured instructional video not merely increased objective

knowledge and procedural understanding, but equally important, increased subjective beliefs about the capacity for independent technique application. This self-efficacy development represents a critical educational outcome because research demonstrates that students with high self-confidence regarding technical capabilities demonstrate greater persistence when encountering difficulties, more active problem-solving when execution challenges arise, and stronger motivation to continue skill development beyond formal instruction periods.

The multidimensional competency development demonstrated in this study reflects best practices in cinematography pedagogy, which recognizes that film technique mastery requires integration of technical execution, functional application in narrative contexts, emotional or dramatic understanding, and psychological confidence in independent capability. Traditional cinematography instruction, emphasizing technical mechanics without attention to communicative and emotional dimensions, often produces students with limited procedural knowledge who struggle to make intentional artistic decisions or apply techniques creatively in novel contexts. Conversely, cinematography instruction emphasizing artistic vision without attention to technical foundations produces students who are unable to execute creative intentions effectively with available equipment. The instructional video developed in this study, through a systematic MDLC development process incorporating multiple competency dimensions, supported comprehensive cinematography learning addressing technical, functional, emotional, and affective domains simultaneously. The substantial improvements across all competency dimensions, confirmed through statistical significance testing, suggest that this multidimensional instructional approach proves more effective than narrowly focused technical instruction.

Multimodal Learning Principles and Cognitive Load Reduction

The effectiveness of the instructional video in promoting learning outcomes reflects the successful application of cognitive load theory principles and multimedia learning theory in instructional design and content delivery. Cognitive load theory, developed through extensive psychological research on human information processing, posits that working memory possesses limited capacity for processing information, and that instructional design should minimize extraneous cognitive load from poorly designed presentation while supporting germane cognitive load directed toward meaningful learning [37]. The instructional video employed multiple design strategies specifically intended to reduce extraneous load while supporting effective information processing. First, the sequencing of five distinct dolly technique demonstrations, presented individually rather than simultaneously, allowed learners to focus cognitive resources on understanding one technique thoroughly before integrating knowledge of subsequent techniques. This sequential presentation, contrary to a comprehensive demonstration attempting to show all techniques simultaneously, represents direct application of cognitive load theory principles, reducing working memory burden.

The incorporation of multimodal presentation combining visual demonstration, synchronized narration, directional arrows, animated overlays, and technique labels reflects Mayer's Cognitive Theory of Multimedia Learning, which posits that dual-channel information processing through visual and auditory inputs enhances learning efficacy

compared to unimodal presentations relying exclusively on visual or auditory channels. Visual information processing through perception of dolly movement, spatial relationships, and framing composition engages the visual-pictorial channel of working memory, while simultaneous auditory processing of narration explaining technique principles engages the auditory-verbal channel. By activating both channels through coordinated multimodal presentation, the instructional video supported the learner's ability to build richer mental representations integrating multiple information sources compared to unmodal instruction relying exclusively on one processing channel. The explicit verbal labels identifying technique names, directional arrows highlighting movement direction, and animated overlays showing camera path and positioning further supported visual-auditory integration by providing clear visual anchors for auditory information and verbal labels corresponding to visual phenomena.

Critically, the instructional video avoided common multimedia design errors that increase cognitive load and reduce learning effectiveness. Common pitfalls in educational video development include excessive visual complexity, overwhelming visual processing capacity, rapid pacing preventing adequate time for information encoding and integration, competing audio narration and background music requiring allocation of limited auditory processing capacity, and animated elements serving decorative rather than instructional functions. The instructional video maintained visual simplicity through consistent framing, clear subject focus, and avoidance of unnecessary visual elements competing with core content. Narration pace aligned with visual phenomena, allowing learners adequate time to process visual information while hearing corresponding explanations. Background music, deliberately kept at low intensity levels, enhanced engagement without distracting from instructional content or competing with narration for auditory processing resources. Animated elements, including directional arrows, motion overlays, and technique identifiers, served explicit instructional functions, highlighting critical technique characteristics rather than decorative purposes. This disciplined approach to multimedia design reflects mature instructional design practice grounded in cognitive science research regarding information processing limitations and multimedia learning principles.

Research on visual demonstration in procedural skill learning demonstrates the particular effectiveness of showing realistic tools and environments rather than simplified instructional materials. The instructional video, filmed with professional-quality equipment (iPhone 16 Pro) at industry-standard specifications (1080p, 24 fps), presented dolly techniques through realistic cinematographic implementation rather than simplified or pedagogically isolated demonstrations. Students observed actual dolly tracks, professional camera positioning, real locations, and authentic lighting and compositional decisions alongside technique demonstrations. This authenticity supported transfer of learning from instructional context to students' own cinematography projects, because learners observed techniques within contexts resembling production environments they would encounter during independent film production. Conversely, instructional approaches demonstrating techniques through overly simplified or artificial contexts risk creating classroom learning that fails to transfer to professional practice contexts due to insufficient similarity between learning and application environments.

The effectiveness of cognitive load reduction through instructional design is evidenced by student reports that the video proved engaging, easy to follow, and provided clear visual demonstrations of each technique. Engagement represents a critical mediator of learning in video-based instruction, because sustained attention enables adequate cognitive processing while disengagement results in minimal information encoding regardless of content quality or presentation clarity. The structured pacing, multisensory information presentation, and motivational elements incorporated through deliberate instructional design maintained learner attention throughout the 2:05 video duration. Student perceptions of ease in following instructional content suggest that the video design successfully matched presentation complexity to learner processing capacity, avoiding both oversimplification, creating boredom, and excessive complexity, creating cognitive overload. The clear visual demonstrations, as reported by respondents, indicate that deliberate incorporation of visual cues, labels, and movement indicators successfully guided learner attention toward relevant technique characteristics and supported visual learning of procedural knowledge.

Practical Readiness and Self-Efficacy in Applied Contexts

The substantial increase in student self-confidence regarding independent application of dollies techniques represents an important educational outcome extending beyond knowledge acquisition toward readiness for authentic cinematography practice. Bandura's social cognitive theory emphasizes that self-efficacy beliefs, representing individuals' confidence in their capability to execute specific behaviors successfully, function as powerful predictors of actual task performance, persistence through difficulties, and continued skill development following formal training termination [38], [39]. The instructional video contributed to self-efficacy development through multiple mechanisms aligned with the theoretical understanding of how self-efficacy emerges. First, mastery experiences through observation of technique demonstration and successful comprehension during video viewing provide vicarious mastery experiences supporting belief development that techniques remain learnable and executable. Second, social modeling through observation of techniques implemented by competent practitioners provides an informational foundation for the expectancy that observers similarly possess the capability to execute demonstrated techniques. Third, verbal persuasion through narration emphasizing learner capability and technique applicability to diverse contexts provides encouragement supporting efficacy belief development. The combination of these efficacy-building mechanisms within the instructional video design contributed to strong posttest responses regarding confidence in independent technique application.

Research examining the relationship between self-efficacy and actual technical performance demonstrates that efficacy beliefs predict not only initial skill acquisition but equally important, persistence and continued development following formal instruction. Students possessing high self-confidence regarding technical capabilities demonstrate greater willingness to attempt technique application despite encountering initial implementation challenges, more active problem-solving when technical execution proves difficult, and sustained motivation to continue skill refinement beyond formal instruction periods. Conversely, students possessing low self-efficacy regarding technical capabilities

often avoid technique application despite possessing adequate knowledge, interpret initial difficulties as evidence of incapability rather than a normal learning process, and discontinue skill development following formal instruction completion. The substantial improvement in self-confidence documented in this study, therefore, represents not merely an affective outcome but a practical predictor of students' likelihood to implement learned doll techniques in authentic cinematography projects and continue technical skill development following instruction completion.

The development of practical readiness through structured video instruction aligns with contemporary cinematography pedagogy, recognizing that effective film education requires integrating technical instruction with psychological preparation for independent practice. Film production education programs emphasize that students require not merely technical knowledge of equipment operation and procedure execution but also psychological readiness to make independent decisions, troubleshoot technical challenges, and persist through implementation difficulties. The instructional video contributed to this practical readiness development by presenting dolly techniques through realistic production contexts, explaining decision-making rationale underlying technique application choices, and emphasizing learner capability to implement techniques independently with available equipment. The integration of technical content with efficacy-building elements within a single instructional resource provides an efficient pedagogical approach, developing both knowledge domains and psychological readiness simultaneously. Students emerging from the instructional video viewing experience not only understood dolly technique principles and procedures but, equally important, possessed confidence in their capability to apply this knowledge independently in authentic cinematography contexts.

The multidimensional improvement pattern across conceptual understanding, functional application, emotional interpretation, and self-confidence suggests that the instructional video supported holistic cinematography learning rather than narrow procedural skill development. Research examining cinematography education emphasizes the importance of an integrated approach addressing technique knowledge, creative application, emotional communication, and psychological readiness for independent practice. Instructional approaches isolating technique knowledge from practical application contexts produce students who are able to describe procedures verbally but are unable to implement techniques independently when filming real projects. Approaches emphasizing procedural execution without attention to emotional and communicative dimensions produce technically competent cinematographers unable to make intentional artistic decisions serving narrative purposes. The comprehensive instructional approach employed in this study, addressing multiple competency dimensions simultaneously, supports more robust learning outcomes, supporting both knowledge acquisition and practical readiness for authentic cinematography practice.

4. CONCLUSION

This study confirms that the MDLC-based instructional video effectively serves as a multimedia learning resource for cinematography education, systematically enhancing students' competencies in dolly camera techniques across conceptual, functional, emotional,

and self-efficacy domains through structured audio-visual design grounded in cognitive load and multimedia learning principles. These findings imply practical recommendations for film educators and instructional designers, including the integration of similar validated video modules into formal curricula to bridge theoretical knowledge gaps and foster practical readiness, as well as scalable adoption of YouTube for accessible, asynchronous delivery in resource-limited settings like Indonesian tertiary institutions. However, the research is delimited to a quasi-experimental design with a single-group sample of 100 Indonesian cinematography students, self-reported Likert-scale measures without direct hands-on skill verification, and exclusive focus on five dolly techniques via a short 2-minute-5-second video, limiting generalizability to other cultural contexts, longer interventions, or performance-based outcomes. Future studies could expand by incorporating control groups, multi-platform comparisons, longitudinal tracking of real-world applications, and extension to broader cinematography skills using emerging technologies like AR/VR for interactive practice. At the same time, this research contributes to the public by providing a freely accessible, empirically tested video resource that empowers aspiring filmmakers worldwide to master essential techniques affordably and independently.

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