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Research Article

The Viability of An Authentic Learning Material in Teaching Drug Discovery and Development Course: ADDIE Model Approach

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ABSTRACT

The rapid and dynamic challenges posed by the Fourth Industrial Revolution are continuously reshaping the educational environment creating a difficult task for teachers in educating Generation Z to ensure they are currently aligned with the digital world. This design-based research aimed to develop authentic learning material integrated into the Pharmacy curriculum for teaching drug discovery and development using the ADDIE model. Prior knowledge, perception, practice, and utilization of multimedia played a significant role in analyzing the participants' needs, which were used as requirements for developing the video animation. The minimum standards of the video validation, with an acceptability rating of 4.00 for the quality of audio and visual components, were complied with before using the video during regular class instructions. Infranodus text network analysis was used to analyze the sentiments drawn from the use of multimedia that affect the student's learning experiences and teachers' teaching practices. The underlying themes generated were technology challenges, technology adoption, resistance to change, barriers to skill development, lack of focus, engagement, and interaction. Student performance in the post-test was statistically significantly higher than the pre-test (M=3.95, p=0.001) in three periodic examinations. Students' positive overall learning experience using comprehensive video for effective knowledge transfer was attributed to video quality, content relevance, engagement, production value, accuracy, length, creativity, audio quality, and accessibility. Consequently, a parallel study involving a control and experimental group of respondents is recommended to assess the difference in exposure to the learning material.

Keywords: ADDIE Model, Authentic Learning Material, Drug Discovery and Development, Pharmacy Education

I. INTRODUCTION

The educational environment is constantly being reshaped by the world's rapid and dynamic changes, as well as the challenges posed by the Fourth Industrial Revolution. Pharmacy practice is a collection of knowledge and skills that require refinement to fulfill society's scientific requirements. The primary responsibility of Pharmacy educational institutions in the country is to disseminate refined and authentic drug information. Despite the growing interest in authentic learning and its potential benefits, there remains a significant research gap concerning integrating authentic learning material in drug discovery and development education [1], [2], [3]. Traditional teaching methods and educational resources are outdated, generic, and disconnected from the practical application of knowledge, resulting in students feeling disengaged, unmotivated, and unprepared for real-life situations. Thus, more comprehensive research must be conducted on the effectiveness of authentic learning material through video animation [4]. Authentic learning materials bridge this gap by providing students with content that is directly relevant to their lives and future careers. This necessitates a systematic investigation to evaluate the impact of authentic learning material on students' engagement, comprehension [5], and overall

learning experience and outcome [6]. Nonetheless, this study seeks to bridge the existing research gap, shed light on its value to education, and cope with the current trend of academic pharmacy practice through the development of video animation using the ADDIE model.

II. METHODOLOGY

This study was anchored on the ADDIE Model and divided into five (5) stages: analysis, design, development, implementation, and evaluation. The study's respondents were third-year Bachelor of Science in Pharmacy (BSPh) students officially enrolled in the Academic Year 2023-2024 and the College teachers handling the *Drug Discovery and Development course*. Likewise, the Dean, Head, Program Chair, and/or Officer-In-Charge of the BSPh program served as the validators of the survey tools on the existing educational technology, strategies, and learning environment.

Online Survey Questionnaire. The respondents completed the online survey and structured questionnaire using an electronic form. These survey forms include students' prior knowledge, teachers' and students' perceptions, practices, and sentiment regarding the use of multimedia in teaching and learning, acceptability of the multimedia learning material in terms of audio and visual aspects, and overall learning experience of students after exposure to the formulated animated videos on drug discovery and development.

Single Group Pre-Test and Post-Test Assessment. The pretest-posttest assessment tool in the form of multiple-choice questions was administered before and after each class session to gauge how much the participant had learned and retained.

Interview Guide. The deans and/or heads of the Pharmacy programs and science and language education experts validated the interview's contents. The audio transcription was processed using the Live Transcribe software application, and the written comments were generated from the survey, in which quantitative and qualitative questions were concurrently administered.

ADDIE Model. This design-based research is divided into five phases, as shown in Figure 1.

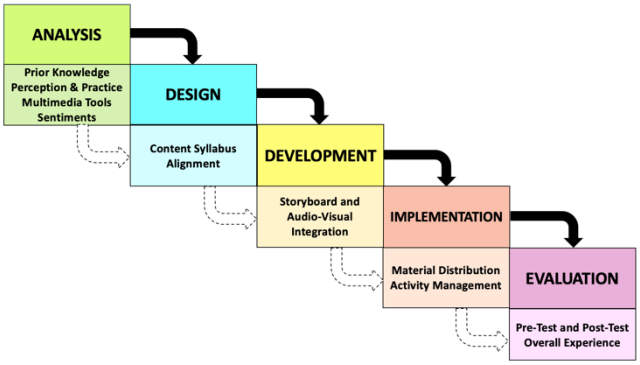

Figure 1 Research Framework

In the *analysis phase*, the researcher prepared two (2) sets of online survey questionnaires containing the same linear- scaled questions using multimedia, technology, and animation software; one for the students recently completing the course and the other for teachers handling drug discovery and development. The last section of the questionnaire was designed for the respondents to enter their comments and reactions. Another consideration in the analysis phase is evaluating students' prior learning o the key topics covered in drug discovery and development. Topics were listed respectively under each unit, and the students were asked to rate according to a linear scale with the legend of (1) no knowledge, (2) minimal, (3) basic, (4) adequate, and (5) superior. The course syllabus was revisited in the *design phase*, and the script content was aligned before narration using the Heygen artificial intelligence narrative animation. The key topics for each unit were obtained from the standard syllabus prepared by the Philippine Association of Colleges of Pharmacy (PACOP) and validated by the four (4) Pharmacy program experts. The script's contents were obtained from drug discovery textbooks, pharmacopeial compendia, memoranda, circulars, and advisories of the Food and Drug Administration, health research ethics guidelines, and published research articles from high-quality health research websites. In the *development phase,* the validated script and content for the narration were the starting point of this stage. The teacher's photo was loaded into

ToonApp AI to cartoonize the photo of the teacher. The script content and cartoonized teacher's photo were fed to Heygen AI to generate the talking avatar and merge it with script content narration. The narrating avatar was then loaded to Filmora to adjust, manipulate, and arrange the storyboard to create the video animation. While managing the storyboard, original and copyright-free photos and video clips were integrated together with the background music. The goal was to create a 3-minute to 5-minute video per unit in an MP4 format with 720 to 1920 pixels. The timeline is based on the validated script aligned with the course syllabus. The courseware in the form of video collections was uploaded to Google Drive, by which individual link for each video was generated to serve as the key to data transmission for the teacher to download as a supplementary educational tool for teaching drug discovery and development courses. The quality assurance checklists for the audio and visual components of the video were based on [7] and [8], respectively. The final step in the development phase is the creation of pre-test and post-test multiple-choice questions. The contents of the questionnaire were validated by the four experts in Pharmacy education. In the *implementation* phase, the pre-tests were given before the start of the term (Prelim, Midterm, and Final). It covered the corresponding lessons based on the standard syllabus created by the Philippine Association of Colleges of Pharmacy (PACOP). Before video exposure, the teacher downloaded the videos through the link and saved them locally on a laptop, desktop, or smartphone. Thirty minutes were allotted for the 20-item pre-test MCQs, which means each item was given a 1.5-minute equivalent duration. The researcher decided to conduct a two-time full play of the video. In the *evaluation* phase, the pre-test and post-test were checked using the Zipgrade mobile application. The answer sheets were coded to ensure anonymity and confidentiality. The scores were recorded in an MS Excel file. The encoding of the data was facilitated by three encoders, the loud reader, the typist, and the silent reader, to ensure the accuracy of the data.

III. RESULTS AND DISCUSSION

Prior knowledge in Table 1 falls within the scale of 1.50 (minimal knowledge) and 3.49 (basic knowledge). Thus, all key topics in the syllabus were the primary considerations when writing the script content in the design phase. Prior knowledge acts as a basis for constructing new knowledge [9] and assists individuals in forming connections and comprehending new concepts more effectively. Persky and Murphy [10] assert that although a small number of students may have the capacity to utilize their prior knowledge in the pharmacy field, most students are unlikely to be able to do so without formal instruction. In the study of Ghazal et al. [11], the initial survey of students enrolled in a pharmaceutical calculation course indicated the necessity of enhancing the current instruction of calculations by introducing a more modern tool to ensure that students achieve the desired proficiency level. This served as the basis for creating authentic learning material through a pre-recorded video. The study of Hasana et al. [12] used the existing sterile dosage form technology learning outcome to develop videos to test the knowledge and skills of pharmacy students. Also, Mnatzaganian et al. [13] utilized the previous quiz performance of the students considered the worst during 2017-2018 as the starting point in creating a video podcast used for students enrolled in 2018-2019. In this study, the pre- requisite courses are considered the major factor in ascertaining prior drug discovery and development knowledge since they contain complex and multi-step processes. The study of Ghaza et al. [11] and Hasana et al [12] noted that pharmaceutical calculations and manufacturing procedures required the assessment of prior knowledge of the students, respectively.

Table 1. Prior knowledge of students on Drug Discovery and Development

Topic Title	Rating	Description
Biology of the Disease	2.8	Basic
Pre-Formulation Studies	2.8	Basic
In-vitro Studies	2.7	Basic
In-vivo Studies	2.7	Basic
Ethical Considerations in Animal Research	2.7	Basic

Ethical Considerations in Human Research	2.7	Basic
Phases of Clinical Trials (Phase 1-2-3)	2.7	Basic
Pre-Marketing Studies (FDA Approval)	2.7	Basic
Natural Product Research	2.6	Basic
Target Identification and Validation	2.6	Basic
Investigational New Drugs	2.5	Basic
Intellectual Property Rights	2.5	Basic
Clinical Trial Design	2.4	Minimal
Clinical Trial Core Documents	2.4	Minimal
Clinical Trials Guidelines	2.4	Minimal
Post-Marketing Surveillance	2.4	Minimal
Ethnopharmacology	2.3	Minimal
Hit Identification	2.3	Minimal
Lead Optimization	2.3	Minimal
Computer-Aided Drug Design (CADD)	2.3	Minimal
Current Systems and Technology	2.3	Minimal
Precision Medicine Clinical Trials	2.2	Minimal
Microchip Modelling Clinical Trials	2.1	Minimal

The level of perception and practice of students in the use of multimedia shown in Table 2 reveals that the students rated their confidence in using multimedia the least (M =3.66). The factor that can be attributed to this is the teacher's influence. Insufficient multimedia understanding, time, and technology software can hinder one's ability to effectively explain a topic through a fast-paced video presentation or slide discussion. Teachers with negative attitudes toward technology may discourage students from exploring multimedia for learning. A good teacher with strong teaching skills may need proper access to training, technical support, and effective resources

to deliver quality material. Pennycook & Rand [14] stated that insufficient information from confusing sources with low-quality audio can make it difficult for students to understand the lesson on an easy-to-access platform. Ultimately, this highlights the need for more effective videos, which are important in improving overall learning outcomes. Lastly, poor internet connection and network issues can also affect the mood and stability of learning. Students tend to feel exhausted when the loading and smooth playing of the videos are disrupted because it breaks the momentum and harmonious flow of learning.

Table 2. Perception and practice of students on multimedia utilization

	Questions	Rating
Perception	How effectively do you believe multimedia enhances your understanding of the subject matter?	4.25
	Do you believe that multimedia improves your ability to retain and recall information from your studies?	4.13
	To what extent do you believe multimedia aids in making complex concepts easier to comprehend?	4.15
	Do you believe that multimedia resources provide a more stimulating and interactive learning environment compared to traditional methods?	3.76
Practice	To what extent do you believe multimedia resources effectively cater to different learning styles?	3.98
	How helpful do you find multimedia in clarifying complex or abstract concepts?	4.1
	How often do you feel motivated to engage with multimedia content during your studying?	3.96
	How satisfied are you with the integration of multimedia in your learning experience?	4.19
	How often do you find yourself engaged with multimedia content during your learning experience?	4.12
	How confident are you in navigating and utilizing multimedia resources like video animation for your learning needs?	3.66

The level of perception and practice of teachers in the use of multimedia shown in Table 3 depicts that the teachers rated their mastery in creating animated multimedia the least (M=3.82). The information generated in this context supports the reason for the lowest rating of students in terms of their confidence in educational technology tools. Teachers' low mastery of multimedia is caused by a lack of training and hands-on experience in manipulating the video editing platform. Many teachers are trained in traditional teaching methods and may not

have had the opportunity to develop their skills in using multimedia tools [15]. Teachers who have been teaching for a long time may be resistant to change, prefer traditional teaching methods that they are familiar with, and may feel overwhelmed by the rapidly evolving digital landscape. Learning how to use multimedia tools and integrating them into lessons can be time-consuming. It is important to note that these reasons are not exhaustive and may vary from teacher to teacher, institution to institution, and system to system. However, addressing these challenges through training, support, and access to resources can help teachers improve their mastery of using multimedia.

Table 3. Perception and practice of teachers on multimedia utilization

	Questions	Rating
Perception	How comfortable are you with incorporating multimedia and technology into your teaching practices?	4.46
	How confident are you that animated video can enhance the learning of students in Pharmacy professional courses?	4.4
Practice	How often do you use multimedia tools to enhance student engagement and interest in the subject matter?	4.19
	How well do you integrate technology and multimedia to present information clearly and visually appealing to the learners?	4.19
	How well do you create an animated multimedia in enhancing your teaching practices?	*3.82
	How effectively do you assess the impact of technology and multimedia on student learning outcomes?	4.4

Sentiment analysis of students' responses reveals whether the emotional tone of the message is positive, negative, or neutral. Based on the survey, 75% stated negative feedback, 21% positive, and 4% had neutral responses. The subthemes generated by the various challenges the students encounter in using educational technology tools in learning and teachers' practices are *technology challenges, resistance to change, technology adoption, barriers to skill development*, and *lack of engagement and interaction in teaching*. Using the InfraNodus text network analysis, figure 2 shows the web of information that supports the emerging keywords with the highest local influence: *information, attention, presentation,* and *span*. These keywords lead to the evolution of topics, filtered according to the number of occurrences per text segment. Information, attention, presentation, and span of students are all interconnected and play essential roles in the learning process. For students to learn effectively, they need access to accurate and relevant *information*. This can be provided through textbooks, lectures, online resources, or other authentic educational materials. Students' *attention* is crucial for effective learning. They need to be able to focus and concentrate on the information being presented to process and understand it. Distractions, fatigue, or lack of interest can negatively impact attention levels. The way information is presented to students can greatly influence their learning experience. Effective *presentation* techniques can enhance understanding, engagement, and retention of information. This can involve visual aids, demonstrations, real-life examples, storytelling, or multimedia tools. The *span* of students refers to the range of abilities, learning styles, and backgrounds within a group of learners. Students may have different levels of prior knowledge,

skills, and interests. Educators need to consider the diverse span of students and adapt their teaching strategies to meet individual needs.

Bridging the gap based on subthemes and emerging keywords between student learning and the challenges encountered in using multimedia, the network analysis suggested the strategy of *Finding Creative Solutions* as the overall theme. The summary of insights suggested that the students are gearing toward unlocking the potential of finding creative solutions for learning and leading through material availability and effective training opportunities. The emerging keywords elucidated the collective insights regarding students' responses.

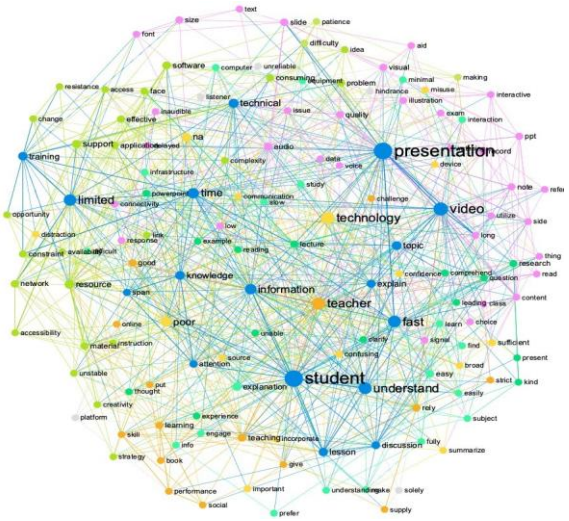

Figure 2 Network graph image of the challenges encountered by students in using multimedia

Sentiment analysis of teachers' responses reveals whether the emotional tone of the message is positive, negative, or neutral. Based on the survey, 100% stated negative feedback, while 0% had positive and neutral responses. The subthemes generated by the various challenges encountered by teachers in using educational technology tools in learning and student practices are *technology challenges*, *technology adoption*, *barriers to learning*, and *lack of focus and engagement in learning*. Using the InfraNodus text network analysis, figure 3 shows the web of information which supports the emerging keywords with the highest local influence, and these are *online, file, due,* and *software*. These keywords lead to the evolution of topics, filtered according to the number of occurrences per text segment. Online, file, due, and software can all be useful tools for teaching in a digital environment when converged rationally. *Online* teaching has become increasingly popular in recent years, especially with the advancement of technology and the widespread availability of internet access. In the text analysis of this study, online challenges regarding the use of educational technology tools and multimedia are covered. *Files* are digital documents that can be shared and accessed electronically. In teaching, files can be used to distribute course materials, such as lecture notes, handouts, readings, worksheets, or assignments. Teachers' response regarding the provision of learning materials tends to cause dependency of the students on technology. *Due* typically refers to deadlines or submission dates for assignments or assessments [16]. Due dates and student submissions are important aspects of the education system. These play a crucial role in ensuring that students complete their assignments and assessments on time. Lastly, software refers to computer programs or applications that can be used to perform specific tasks or functions [17]. This keyword is connected to technical support since the responses highlighted the availability of software and training on using these resources.

Bridging the gap based on subthemes and emerging keywords between teachers and the challenges encountered in using multimedia, the network analysis suggested the strategy of *Maximizing Learning with Valuable Resources* as the overall theme**.** The summary of insights reveals that teachers are concerned with the use of technology, the availability of resources, and students' dependency on technology, leading to distraction. The emerging keywords elucidated the collective insights regarding students' responses.

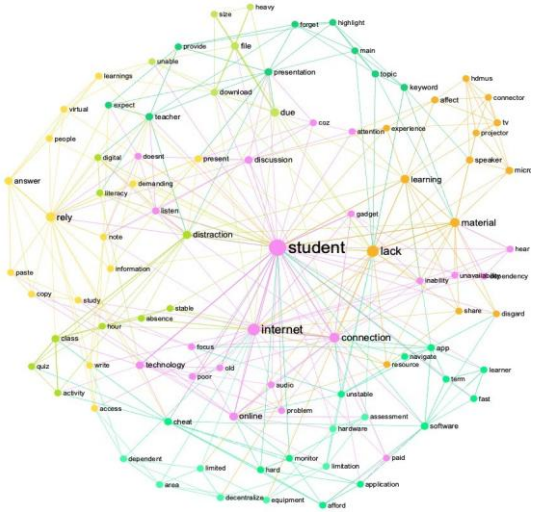

Figure 3 Network graph image of the challenges encountered by teachers in using multimedia

User reviews from reputable websites across different operating systems were used to select audiovisual and animation software and applications. The average rating shown in Table 4 from three (3) operating system platforms (iOS, Android, and web-based) reveals that all of the applications were rated above 4.0. According to Samuels [18], a good application rating for digital purposes is 4.0 and above. Thus, this conforms to Samuels's recommendation. The company-based platform was excluded from the rating since its utilization was for gathering short video clips to augment the contents in the dashboard rather than classifying software applications in video animation.

Table 4. Average user review rating on digital audio and visual application software

Parameters	Software	Rating
Video Animation	Filmora (FM)	4.6
Script Narration	Heygen	5
Canvas Background	Filmora (FM)	4.6
Still Avatar	ToonApp	4.5
Speaking Avatar	Heygen	5
Still Photo Editor	PhotoRoom	4.8
	Android in-app (Samsung)	4.4
	IOS in-app (Apple)	4.6
Image Source	Pexel(Copyright-free)	4.7
	Pixabay (Copyright-free)	4.8
Video Clip Source	Company-based	NA
Voice Gender	Heygen - Female	5
Text Graphics	Filmora (FM) Add-ins	4.6

Music Background	Filmora (FM) Add-ins	4.6
Mobile Devices Used	Samsung Galaxy Fold 4 (2022)	4.5
	Iphone 14 Pro Max (2022)	4.5
	Ipad Pro 12.9 (2022)	4.5
	Macbook Pro Touchbar (2020)	4
Output Format	mp4	4.5

Table 5 reveals the evaluation of the six experts on the quality of the video's audio and visual aspects according to the degree of agreement with the quality standards set by Udemy [7] for the audio and Webdew [8] for the visual component. Based on the degree of agreement on the audio component, the scale-level content validity index (S-CVI) is 1.00; this conforms to the required value by Lynn [19], which is at least 1.00. Consequently, the degree of agreement for the visual component, the scale-level content validity index (S-CVI), is 0.92, and it did not conform to the required value which is at least 1.00. Thus, editing was performed in the visual illustration or storyboard and animation. However, after the second validation of the video, a 1.00 scale-level content validity index (S-CVI) was achieved. A video's audio and visual components can enhance the learning experience and capture and maintain the viewer's attention. This engagement helps create a more immersive learning experience, making it easier for learners to focus on the presented content. Studies have shown that combining audio and visual information can improve information retention. Learners receiving information through multiple sensory channels enhances their ability to remember and recall the information later. Visual elements such as images, graphs, and animations can help clarify complex concepts or processes. When combined with audio explanations, learners can better understand the presented information, as they can both see and hear the explanations simultaneously. It facilitates multisensory learning, as people have different learning styles. Some individuals may prefer auditory learning, while others prefer visual learning. Incorporating audio and visual elements in a video caters to a wider range of learning preferences, ensuring that more learners can effectively grasp the content. According to McHugh [20], audio elements, such as background music or narration, can help create an emotional connection with the content. This emotional engagement can enhance the learning experience, making it more enjoyable and memorable for the viewer. Thus, a video's combination of audio and visual components enhances engagement, retention, and comprehension, caters to different learning styles, and creates an emotional connection, all contributing to effective learning.

Table 5. Evaluation of the quality of audio and video components

Parameters	**Experts' Rating**						**Ave**	**CVI**	**UA**
Audio Component	**E1**	**E2**	**E3**	**E4**	**E5**	**E6**	**EA**		
Free of echo	4	4	4	4	4	4	6	1	1
Free of background noise	4	3	4	4	3	4	6	1	1
Free of distortion	4	4	4	4	4	4	6	1	1
Free from background hiss	4	4	3	4	4	3	6	1	1

Sounds come out of both speakers	4	4	4	4	4	4	6	1	1
Volume is well modulated.	3	4	4	4	3	4	6	1	1
Free of pop ups	4	4	4	4	3	4	6	1	1
PR	1	1	1	1	1	1	1	1	1
Video Comp. (1st Run)	**E 1**	**E 2**	**E 3**	**E 4**	**E 5**	**E 6**	**E A**	**C VI**	**U A**
Script	4	4	3	4	3	3	6	1	1
Voiceover	4	3	3	4	4	3	6	1	1
Visual Illustration/Story board	4	4	2	4	3	3	5	0.83	0
Animation	3	4	2	4	3	3	5	0.83	0
PR	1	1	0.5	1	1	1	0.92	0.92	0.5
Video Comp. (2nd Run)	**E 1**	**E 2**	**E 3**	**E 4**	**E 5**	**E 6**	**E A**	**C VI**	**U A**
Script	4	4	3	4	3	3	6	1	1
Voiceover	4	3	3	4	4	3	6	1	1
Storyboard	4	4	3	4	3	3	6	1	1
Animation	3	4	4	4	3	3	6	1	1
PR	1	1	1	1	1	1	1	1	1

Table 6 shows the detailed rating of four (4) experts on the lesson content. It reveals that the average curriculum rating is 4.75 (acceptable), the material rating is 4.55 (acceptable), and the evaluation rating is 4.42 (acceptable). The parameter rated the least (4.00) is "the material represents real life." According to Ranganathan et al. [21], drug discovery and development are a complex process, and the stages of finding new drugs are difficult, costly, time- consuming, and risky. Typically, it takes ten to fifteen years to get a medication approved for sale. Thus, transforming the entire course and putting all the context in real life is difficult because every drug entity is unique and has specific clinical documents that cannot be adopted solely for all classes of drugs. To resolve this gap, the lesson should represent real life by incorporating real-world examples to help students see the practical application by adding authentic resources like research articles, videos, or interviews. Hands-on activities like simulations, role-playing, and collaboration, such as group work, case studies, seminars, and workshops, can also enhance the representation of the lesson in the real world [22]. Overall, the key is to make the lesson relatable, practical, and meaningful to students' lives outside the classroom. Consequently, the suitability of these approaches may vary based on the learning environment, resources, and needs of the students.

Table 6. Acceptability of the lesson content

Lesson Content	Parameters	Average	Description
Curriculum	Material suitability with basic competence	4.75	Acceptable
	Material suitability with indicator	4.75	Acceptable
	Material suitability with learning objectives	4.75	Acceptable
	Average	**4.75**	**Acceptable**
Material	Material is supported by appropriate media	4.75	Acceptable
	Material is easy to understand	4.50	Acceptable
	Material represents real life	4.00	Acceptable
	Material gives any source to learn something	4.50	Acceptable
	Material uses appropriate and consistent language	5.00	Acceptable
	Average	**4.55**	**Acceptable**
Evaluation	The evaluation (pre-and post-test) is within the scope.	4.75	Acceptable
	The suitability of evaluation with the material	4.25	Acceptable
	The degree of competence of the questions in the pre-and-post test	4.25	Acceptable
	Average	**4.42**	**Acceptable**

Table 7 presents the detailed rating of four (4) experts on the learning design. It shows that the average rating of learning objectives is 4.88 (acceptable), strategy is 4.38 (acceptable), and evaluation is 4.88 (acceptable). Among the parameters evaluated on the learning, the learning material's systematic delivery and motivational drive were rated intermediate with a value of 4.25, within the acceptable range. The learning material was rated

5.00 in terms of appropriateness and consistency of the language used. Georgiou et al. [23] reiterated that clear and concise language helps the reader get around and avoids confusion. Key terms use particular words and phrases to convey the primary ideas of a piece of writing. They provide coherence to writing and draw the reader's attention to crucial details. Likewise, Knox [24] posted in a standard blog that maintaining consistency in language can help students feel at ease knowing what is expected of them in the classroom and offer predictability in a world where other aspects of their lives are unpredictable. The experts highlighted that the learning design is SMART (specific-measurable-achievable, relevant, and time-bound. Based on the experts' comments, a video presentation may only ensure a partial transfer of knowledge to some learners since it covers more auditory and visual learners. However, the suggestion was to create additional activities besides the written assessment to effect differentiation. According to Landrum & McDuffie [25], a teacher must use various instructional materials and resources to cater to different learning preferences. On the other note, the learning design's motivational drive must be considered. Regularly provide constructive feedback on students' work and progress to help them understand their strengths and areas for improvement and encourage them to continue working towards their goals [26]. Foster a positive and inclusive classroom atmosphere where students feel safe to share their thoughts and ideas.

Table 7. Acceptability of the learning design

Design	Parameters	Average	Description
Objectives	The clarity of learning objectives	4.75	Acceptable
	The consistency of objectives, material, and evaluation	5.00	Acceptable
	Average	**4.88**	**Acceptable**
Strategy	Systematic delivery of material	4.25	Acceptable
	Able to motivate the students	4.25	Acceptable
	Attract students' interest	4.50	Acceptable
	Give chance to the students to learn independently	4.50	Acceptable
	Average	**4.38**	**Acceptable**
Evaluation	Give evaluation to test students' understanding	5.00	Acceptable
	The questions suitable to learning indicators	4.75	Acceptable
	Average	**4.88**	**Acceptable**

The four (4) experts conducted an evaluation of the contents of the multiple-choice questions according to the degree of clarity. It reveals that the scale-level content validity index (S-CVI) is 1.00. this conforms to the required value by Polit & Beck [27] and Polit et al. [28], which is at least 1.00. The Wilcoxon Signed-Rank Test in Table 8

reveals that the mean post-test scores of HEI-1 (p=0.001), HEI-2 (p=0.001), HEI-3 (p=0.001), and HEI-4 (p=0.001) were

statistically significantly higher than the mean pre-test scores in the prelim, midterm, and final coverage. The viability of the learning material was also assessed through students' feedback which reflect their overall learning experience before, during, and after exposure with the video.

Table 8. Differences in the mean pre-and-post test scores in prelim, midterm, and final term

Prelim					
HEI	**Test**	**W**	**z**	**p**	**Interpretation**
HEI-1	Post-Pre-Test	1124	-8.71	<.001	Accept Ho
HEI-2	Post-Pre-Test	0	-4.87	<.001	Accept Ho
HEI-3	Post-Pre-Test	6	-4.41	<.001	Accept Ho
HEI-4	Post-Pre-Test	21.5	-3.13	<.002	Accept Ho
Midterm					
HEI	**Test**	**W**	**z**	**p**	**Interpretation**
HEI-1	Post-Pre-Test	850	-9.4	<.001	Accept Ho
HEI-2	Post-Pre-Test	9	-3.59	<.001	Accept Ho
HEI-3	Post-Pre-Test	93	-2.88	<.004	Accept Ho
HEI-4	Post-Pre-Test	0	-3.63	<.001	Accept Ho
Final					
HEI	**Test**	**W**	**z**	**p**	**Interpretation**
HEI-1	Post-Pre-	237	-9.6	<.00	Accept

	Test	.5	6	1	Ho
HEI-2	Post-Pre-Test	0	-4.3	<.001	Accept Ho
HEI-3	Post-Pre-Test	39	-3.99	<.001	Accept Ho
HEI-4	Post-Pre-Test	14	-2.97	<.003	Accept Ho

Legend: p-value < 0.05 – Accept Ho

Table 9 shows that the authentic learning material was acceptable to students from four (4) HEIs based on video quality, content relevance, engagement, production value, accuracy, length, creativity, audio quality, accessibility, and overall impact fall within the acceptable range (4.21-5.00).

Table 9. Acceptability of the authentic learning material among students

Parameters	**HEI-1**	**HEI-2**	**HEI-3**	**HEI-4**	**Ave**	**Description**
Quality	4.31	4.42	4.29	4.33	4.34	Acceptable
Relevance	4.31	4.4	4.27	4.22	4.3	Acceptable
Engagement	4.31	4.44	4.29	4.28	4.33	Acceptable
Production	4.34	4.42	4.3	4.28	4.34	Acceptable
Accuracy	4.3	4.4	4.27	4.39	4.34	Acceptable
Length	4.31	4.45	4.3	4.22	4.32	Acceptable
Creativity	4.3	4.44	4.29	4.39	4.34	Acceptable
Audio Quality	4.31	4.4	4.3	4.22	4.31	Acceptable
Accessibility	4.31	4.42	4.3	4.44	4.37	Acceptable
Overall Impact	4.31	4.44	4.3	4.22	4.32	Acceptable

Qualitative data analysis of students' experiences, trend structure, and emerging keywords on the learning process through video learning using InfraNodus text network analysis generated this theme: *Comprehensive Video for Effective Knowledge Transfer*. Consequently, the trend structure of emerging keywords, namely, *clinical, giving, idea,* and *add* was generated to support the theme. Relating the most influential keywords the researcher synthesized that learning is a dynamic and engaging process that involves the visual exploration of *ideas* and the discovery of new knowledge. It is a stage where individuals seek to understand and explain various topics, emphasizing the *clinical* trials involved in drug discovery and development. To facilitate this process, it is essential

to present information in a short, understandable manner, making it easy for learners to grasp key points. Visual aids play a crucial role in helping learners absorb and retain information effectively. By *giving* the needed support and guidance, these aids enhance the learning experience and promote a deeper understanding of the topic. Therefore, visual learning is a valuable tool that can greatly assist individuals in their quest for *additional* knowledge and help them achieve their learning goals. As the students commented, this indicates the benefits of watching informative videos on drug discovery and development.

> "The videos really helped me understand the topic more because they were very informational, and I understood what was being taught. Also, because we've already gone through those topics before so, being refreshed with that knowledge through the video helped me remember and understand more. Watching videos adds a dynamic and interactive element to the learning process of students, such as visual/multimedia representation of information and contextualization. Making it more immersive and enhancing our understanding of the topic at hand about Drug Development and Discovery, in which I learned the overall process of discovering and developing new drugs, including the various stages involved. The video has given me a wider range of knowledge regarding drug discovery and development. I was able to understand each phase and got to learn that discovery of new drugs is not easy."

Another theme generated is *Streamlined Success: Crafting an Effective Learning Experience for Students*. According to the trend structure of emerging keywords, namely, *graphics*, *speaker*, *explain*, and *topic* were generated to support the theme. Relating the most influential keywords, the researcher synthesized that easy and student-friendly content, combined with excellent quality, creates a positive learning environment. A good *topic* selection and comprehensive *explanations* delivered by a digital-*speaking avatar* utilizing a human-like voice further enhance the learning process. In this context, *graphics* in videos play a significant role. Additionally, the involvement of students in the learning process fosters active participation and deeper understanding. Moreover, the authority and credibility of the sources used in the learning materials are essential. Trustworthy and reliable information promotes a sense of confidence in students, encouraging them to explore and discover new knowledge. The students commented on the video quality's impact on their understanding of drug discovery and development.

> "The video's high-quality audio and visual content are so clear and easy to understand, making it easier for us students to follow along and absorb the materials/information about drug discovery and development. It's different stages/phases and activities involved in transforming a compound from a drug candidate (the end-product of the discovery phase) to a product approved for marketing by the appropriate regulatory authorities. My experience on watching the video is good. It makes me understand whatever the speaker is explaining. It gives us information and knowledge that we can use in the future. Throughout our learning journey, I gained a comprehensive understanding of the challenges, processes, and regulations involved in drug discovery and development, providing you with a foundation in pharmaceutical research and development. The quality of the video is creative, with detailed pictures of the lesson and clear explanations. The slides shown in the video need a little improvement. The videos were excellent, easy to understand, and engaging. I had a positive experience and learned from it, even for a short discussion."

Furthermore, another theme generated is *Impact of Natural Products Through Scientific Video Learning*. Consequently, the trend structure of emerging keywords, namely, *drug, area, identification*, and *clear* were generated to support the theme. Relating the most influential keywords the researcher synthesized that in the realm of video content, students seek to grasp the details and *clarity of information* presented in *drug discovery and development*. They have questions that require clear answers, prompting elaboration in the clinical trials. The *area* that needs further clarification is the *target identification* of the natural drug products that will elicit its effect. Likewise, *ethnopharmacology* (medicine and culture) was also another concern, where research was conducted in some related articles to comprehend the properties of various substances obtained from natural products. Ultimately, the goal is to provide more detailed explanations and examples in utilizing natural resources against the identified target as the starting material for drug product development.

As the students commented, this indicates the topic that needs priority in studying drug discovery and development. Specifically, the participants of the study pointed out their interest in ethnopharmacology and natural products. HEI-3 reiterated that "the videos have a good impact on the viewers, which is why I learn every

detail in the video. There should be a separate detailed video about ethnopharmacology. The process in which the drugs from natural sources should be experimented and needed first to identify the target. HEI-1 also emphasizes, "maybe a few in the parts of clinical trials and more examples in natural products. Likewise, according to HEI-2, "ethnopharmacology and natural product research must be elaborated in details." Additionally, HEI-4 reacted that "the area of the video that needs further clarification to me is the target identification and validation, and also the synthesis of active compound from plants."

IV. CONCLUSION

The developed authentic learning material in Drug Discovery and Development course through video animation increases student performance by simplifying complex concepts, making them easier to understand by breaking the complicated context into visual representations. The combination of visual appeal, engagement, retention, interaction, and multisensory learning in the authentic learning material also significantly contributes to the difference in pre-test and post-test scores, leading to increased student performance in the three periodic examinations. Students' positive overall learning experience using comprehensive video for effective knowledge transfer was attributed to video quality, content relevance, engagement, production value, accuracy, length, creativity, audio quality, and accessibility.

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VII. DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author.

VIII. CONFLICT OF INTEREST

The authors declare that there is of conflict of interest regarding the publication of this paper.

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AUTHORS PROFILE

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