JPAIR Institutional Research Volume 25 • October 2025
DOI: https://doi.org/10.7719/irj.v25i1.965

Animated Pedagogical Resources in Pharmacy: Effects of Prior Knowledge, Learning Outcomes and Classroom Dynamics

RICHIE G. BAYURAN[1], JENNY MARIE D. BLANCAFLOR[2], ERIC JUSTIN M. BLANCAFLOR[3]
[1]Saint Gabriel College, School of Pharmacy, Philippines
[2,3]University of San Agustin, College of Pharmacy and Medical Technology Philippines

Corresponding author: bianrenshi.rb@gmail.com

Originality 100% • Grammar Check: 95% • Plagiarism: 0%

ABSTRACT

Article history:

Received: 13 Feb 2025
Revised: 10 Aug 2025
Accepted: 22 Sept 2025
Published: 30 Oct 2025

Keywords — Education, Animation, Classroom Dynamics, Learning Outcomes, Pharmacy, Prior Knowledge, quasi-experimental research

The rapidly changing landscape of pharmacy education has led to a need for fresh and creative pedagogical strategies that bridge the gap between academic knowledge and distinct professional practice. This study explored the effects of authentic learning material (ALM) on classroom engagement, academic performance and students' prior knowledge. The instructional materials were theoretically and epistemologically positioned within the frameworks of Constructivist Learning, Situated Learning, and Bloom's Revised Taxonomy using Quasi-Experimental Design. The results indicated that pharmacy students had from very little knowledge to basic knowledge about a range of pharmacy topics. The academic performances of the students over a Prelim, a Midterm, and a Final after the use of ALMs were statistically significant (p<0.001). The

classroom observations averaged a 3.02 rating in the relevant checklist category, which indicated consistent and effective delivery of the instructional material from the instructors perspective. Learners' feedback demonstrated improvements in motivation and levels of engagement, and improved levels of interpretation of complex pharmaceutical concepts. Instructors identify the pedagogical nature of the animated material, and expressed frustrations regarding access to limited internet access and having to create the content in a limited time frame. Animation-based ALMs proved to be effective tools for activating prior knowledge, enhancing competency-based learning, and promoting active classroom participation. Pharmacy colleges should consider integrating multimedia in to their curricula, educating faculty on use of digital content creation and increasing their technical infrastructure to ensure the viability of these creative teaching modalities.

INTRODUCTION

Professional education in pharmacy is changing rapidly, moving to prepare future pharmacists for more complicated roles in the delivery of health care. Conventional didactic teaching, although suitable for dissemination of factual knowledge, is not necessarily the best approach to enhance complex decision-making ability or to promote clinician-patient encounters. To meet these evolving demands, innovative pedagogical strategies are needed—particularly those that bridge the gap between theoretical knowledge and real-world professional practice. One promising approach is the integration of authentic learning materials (ALMs) into the pharmacy curriculum. ALMs are constructed to model the complexity of real-world professional tasks and engage students in authentic, situated, student-centered learning experiences (Herrington & Oliver, 2000). These can range from case studies, simulations and theoretical role plays to digital animations for exposing students to professional pharmacy practice situations (Rule, 2006; Lombardi, 2007). Studies show that ALMs promote learner engagement, analytical thinking, and knowledge application to real-world settings (Kawulich, 2012; Cook et al., 2013).

In addition, they evoke the knowledge in head, a fundamental principle of constructivist learning to enhance conceptual learning and long-term retention (Biggs & Tang, 2011). Despite their recognized benefits, there remains a significant gap in systematically evaluating how ALMs contribute to the achievement of intended learning outcomes in local educational settings. Many of the existing readings concentrate on western contexts, despite recognising how ALMs operate in those resource-variable environments seen particularly within this case context in the Philippine pharmacy schools (Maynard, 2013; Savery, 2015).

This disconnect is all the more problematic, as local contexts frequently throw up idiosyncratic challenges with regard to curriculum articulation, preparation of faculty, and nature of student learning. Thus, the aim of this study is to investigate the effect that real-life items in a pharmacy course have on students' pre-knowledge activation, classroom participation and final exam grades. By situating the experience within institutional framing, we aim to inform pharmacy education debate in the Philippines and international dialogue regarding pedagogic impact.

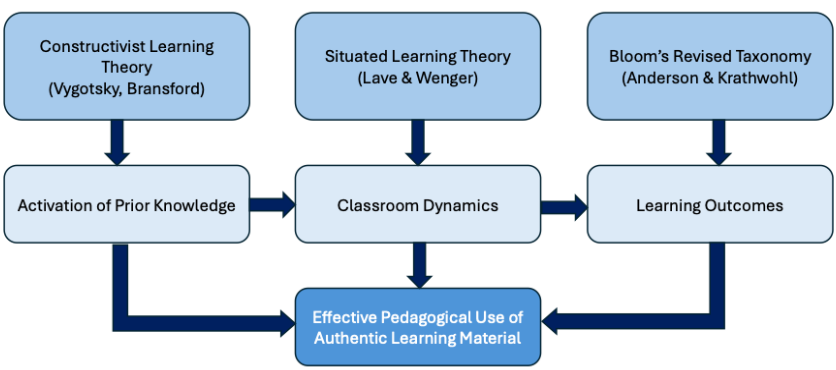
OBJECTIVES OF THE STUDY

This study deals with the development and evaluation of an authentic learning material in pharmacy and its impact to pharmacy students' prior knowledge, learning outcomes and classroom engagement. Specifically, this sought to (1) to assess the extent to which authentic learning materials activate and build upon students' prior knowledge in pharmacy education, (2) to examine how real-world clinical and regulatory content within the materials contributes to applied learning and skill development, (3) to observe the influence of authentic materials on classroom engagement, participation, and peer collaboration, (4) to determine the effectiveness of authentic materials in improving students' academic performance and competency-based learning outcomes, and (5) to gather feedback from students and instructors regarding the perceived relevance and impact of the learning materials in preparing students for real-world pharmacy practice.

FRAMEWORK

The conceptual framework underlying this research is comprised of three learning theories to fully describe how animation entails successful learning for students in pharmacy education. They are illustrated in Figure 1 and include Constructivist Learning Theory, Situated Learning Theory, and Bloom's Revised Taxonomy. Constructivist Learning Theory, with roots in Vygotsky (1978) and furtherdeveloped by Bransford et al. (2000) explains that students learn well when connecting new ideas into pre-existing knowledge. In particular the use of animated teaching aids in this study was purposeful; it allowed students to connect prior knowledge, making learning of new concepts more meaningful and memorable. The use of animations to represent drug mechanisms of action or patients in clinical scenarios may prompt pharmacy students to link abstract concepts with prior experiences. This connection is an important factor for use of multimedia, due to its increased cognitive engagement and meaning, subsequently fostering ease of learning and understanding. The theory of Situated Learning supports the notion that learning is also influenced by context and engaged social dialogue (Lave & Wenger, 1991). In this study's framework, pedagogical animations are positioned as tools to reconfigure the classroom learning environment and facilitate immersion in authentic "practice-based" tasks. rather than traditional lecture type teaching. With the pedagogical animations as representation of real-world pharmacy scenarios, the students could build from collaboration, stimulate questions, and then be engaged with experiential elements that are important for professional practice in pharmacy. Additionally, the apparatus includes Bloom's Revised Taxonomy that arranges cognitive learning objectives in ascending order of thinking level from lower to higher (Anderson & Krathwohl, 2001). Animation in teaching provides a way of developing not only basic knowledge but also skills of analysis and evaluation and creative thought. For example, animations depicting drug interactions or therapeutic pathways can guide students from simple memorization to complex clinical reasoning. Key to this framework is the information pedagogical use of authentic forms of learning material, like animations resources, which intersect with the processes of activating previous knowledge, engaging the classroom and the learning outcomes. Strategically applied, such resources enhance the flow of content creation and delivery to one of active learning, with learners at the center of the educational experience, while promoting a deeper understanding and more successful achievement of a practice-ready pharmacist.

Figure 1
Conceptual Framework of the Study



METHODOLOGY

Research Design and Instruments

A quasi-experimental research design was used for this investigation to adequately assess the effectiveness of animation-based authentic learning materials on the pedagogical outcomes. The research instrument used in this study are survey questionnaires to document the prior knowledge of students, observation checklist to describe classroom dynamics, multiple choice questionnaires for pre-and-post-test to assess the learners' performance, and interview guide to assess the overall experience of both learners and instructors after the use of ALMs. Students' academic performance was measured using Wilcoxon Signed-Rank Test to analyze the difference in the pre-test and post-test over the prelim, midterm, and post-test periods. Teachers' pedagogical approaches and students' engagement behaviors in the classroom were observed through the use of a structured observation checklist, which was assessed using a Likert scale. Narrative reflections from students and feedback from instructors were generated using the interview guide. Thematic analysis was conducted using Infranodus text network analysis.

Respondents of the Study

Total enumeration sampling was used for the study by including all students in pharmacy professional courses at higher education institution (HEI) A and HEI B during the data collection period as participants. Doing this made it possible to consider all learners as users/learners experiencing the animation-based authentic learning materials in professional pharmacy education. In addition, all faculty members of the two HEIs who handle pharmacy professional courses were also included in the study to capture their pedagogical experiences, instructional strategies, and perceptions of the effectiveness of the learning materials (Rosnani & Siti Norzaimalina, 2023). By involving the entire population of both students and instructors engaged in the targeted professional courses, the study ensured inclusive and accurate assessment of the educational intervention.

ADDIE Model. The ADDIE model was used as the main instructional design framework in the creation, implementation, and assessment of pharmacy education animation-based genuine learning resources. To guarantee a methodical and student-centered strategy throughout the research process, the five-stage ADDIE model—Analyze, Design, Develop, Implement, and Evaluate—was employed. The researchers pinpointed particular shortcomings in students' prior knowledge during the Analysis phase and difficulties teaching difficult pharmaceutical topics. Based on curriculum reviews, teacher meetings, and diagnostic evaluations, data informed the choice of subjects for multimedia creation comprising drug discovery, clinical trials, and regulatory processes. During the Design stage, Bloom's Revised Taxonomy helped to guarantee that the educational objectives were in sync with one other. The primary goal was to enhance applied learning and critical thinking among the pupils. Following constructivist and situated learning principles, the learning activities were designed to resemble actual pharmacy scenarios. To arrange the animation, we developed content scripts and storyboards. During the development phase, the animation-based learning resources—including narrated movies, visual simulations, and regulatory dossiers—were developed. Using user-friendly platforms, multimedia components were created and evaluated by pharmacy teachers for relevance and accuracy. Common instruction, pre-tests and post-tests, and class observation were among the embedded animated material. Teachers following established procedures for consistency carried out the sessions.

Research Ethics Protocol

This study is in accordance with ethical standards for human participants. The Saint Gabriel College Research Ethics Board reviewed and authorized the protocol of the study. Informed consent were given to the participants reflecting detailed information about the objectives, methods, potential hazards and benefits of the study. They were assured that they would not have to pay if they dropped out or withdrew their consent, and they were under no obligation to participate. The original data was anonymized by removing all personal identifiers to safeguard the anonymity, and was kept securely with access granted only to the research team. To ensure that participants cannot be identified all findings are reported in aggregate. This study was also conducted according to the principles of the Declaration of Helsinki and national research ethics regulations.

RESULTS AND DISCUSSION

Table 1

Prior Knowledge of Pharmacy Students

Knowledge Level	Rating Range	No. of Topics	Representative Topics
Basic Knowledge	2.50–3.49	13	Biology of Disease, In-vitro/In-vivo Studies, Pre-formulation, Ethics, Clinical Trials
Minimal Knowledge	1.50–2.49	10	Lead Optimization, Clinical Trial Core Documents, Computer-Aided Drug Design, Microchip Modeling

Table 1 shows the self-rated content prior knowledge of pharmacy students in the respective 23 topics in the Drug Discovery and Development module. This data indicate that students have prior exposure to pharmaceutical theory understanding upon entering the course, however are being inadequately exposed to advanced equipment and procedures. This void backs up Kivunja's (2015) claim that readiness for complex learning forms as a result of introduction to the domain at an earlier stage. The findings also suggest a need for more scaffolding in teaching methods that provides contextualization to abstract content, as suggested by Hakkarainen et al. (2016), also emphasize the importance of genuine instructional design in the service of complex knowledge acquisition. The curriculum included real-life course materials, case-study assignments, simulations and regulatory dossier activities that helped fill these knowledge gaps. These resources allowed students to access prior knowledge and build new conceptual schemas over time, following the principles of Dawson and Kumar (2020). For instance, pairing with clinical trial files not only facilitated comprehension of ethical and regulatory issues, it also lead to students' becoming more keenly aware of the limitations concerning documentation practices (Wiggins & McTighe, 2020). Similarly, introduction of more advanced topics such as Computer-Aided Drug Design and Precision Medicine Trials was also bolstered by educational tools that provided real life contexts, facilitating metacognition and the ability to apply fundamental concepts in new contexts (Herrington et al., 2019). In general, the results indicate that real-life learning materials are an important bridge to be gapped between little prior exposure and difficult requirements of advanced pharmaceutical subjects. Ultimately, by situating learning within authentic professional environments, these resources increase engagement have the potential to develop schema and foster the applied preparedness of pharmacy students.

Figure 2
Student Reflections on Animation-Based Learning

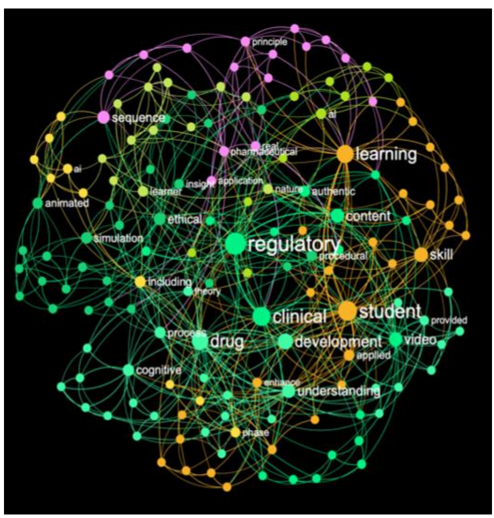


Figure 2 illustrates the text network diagram analyzing applied learning and skill development facilitated by the use of clinical and regulatory video materials. Students' reflections indicated that the videos gave a coherent and structured insight into the steps of DDD, from target identification to commercialization through clinical trials. The clinical segments of the videos—particularly those covering preclinical testing, investigational new drugs (INDs), and phases of clinical trials—were frequently cited as enhancing understanding of regulatory complexities. Students also emphasized that the short but content-rich format of the modules offered sufficient detail for comprehension while minimizing cognitive overload. Findings The results suggested that integrating real clinical (clerkship) and regulatory practice into the instructional videos aided in applied learning and pharmacy education skill development. This resonates with O'Flaherty and Phillips (2015) argument that theory to real-life schooling material strengthens applied learning. Students' reflections indicate that they were able to advance from learning to memorize ultimately, learning in relationship to applying; thus reflecting a paradigm congruent with the constructivist model of professional learning.

The use of animated graphics, simulations, and AI-driven voiceovers reinforced learning by providing a connection between theory and application. This is consistent with principles of multimedia learning (Fiorella & Mayer, 2015) which demonstrate that integrating visual and audio elements leads to greater understanding of concepts. Visual and kinesthetic learners would have profited the most from simulated drug actions, analysis technology, and moral dilemmas- consistent with Wilson and colleagues (2017) on contextualized e-learning and skills transfer. In addition, students' recognition of "just enough" information within short, well-structured videos resonates with cognitive load theory as revisited by Ayres and Paas (2020). In finding a balance between didactic content and accessibility, such modules served as prompts for students to learn explanations of regulatory challenges, ethical issues and therapeutic consequences in ways that promoted procedural thinking as well as clinical reasoning. The infusion of real clinical as well as regulatory video footages significantly enhanced experiential learning in enhancing students' knowledge of pharmaceutical processes or function, building confidence roles and problem solving (ethics related procedural issues). These contributions underscore the pedagogical value of multimedia-based authentic learning tools in preparing pharmacy students for complex, practice-oriented environments.

Table 2

Implementation of Animation-Based Learning

Code	Classroom Observation Checklist	RATING
COI-1	The teacher starts the class with a prayer.	3
COI-2	The teacher checks the attendance of the students.	3
COI-3	There is a classroom seating arrangement.	3
COI-4	The teacher ensures that gadgets don't cause distractions.	3.5
COI-5	The teacher gives a rationale before the pre-test.	3
COI-6	The teacher has a system for distributing the pre-test questionnaire.	3
COI-7	The duration of the pre-test is 20 minutes.	2.5
COI-8	The teacher delivers a short introduction about the animated video.	3.25

COI-9	The teacher plays the animated video twice.	3
COI-10	The teacher allows a 30-minute break, allotted for students' recall.	3.25
COI-11	The teacher gives a rationale before the post-test	3
COI-12	The teacher administers the post-test for 20-minutes.	2.5
COI-13	The teacher has a system for distributing the post-test questionnaire.	3
COI-14	The teacher conducts a short recapitulation of the video presented.	3.25
COI-15	The teacher ends the class with a prayer.	3
	Average	3.02

Table 2 showed the effectiveness of video-integrated teaching from the score of the classroom observation. The average score across 15 Classroom Observation Items (COIs) was 3.02, indicating that teachers as a whole were successful in implementing video-based learning, most obviously in the regard of teachers' consistent orchestration of routines to purposeful use of digital tools. This confirms Fiorella and Mayer (2016) who argued for multimodal design to maintain attention between two source of stimuli such as audio-visual inputs. In the same vein, the successively scheduled pre-test video exposure post-test in 20–25 minutes suggest efficient use of time as also emphasized by Scheerens and Blömeke (2016) when aligning instructional quality to structured time. Some discrepancies between material distribution and test performance are pragmatic barriers, yet teachers offset these with scaffolding mechanisms, notably in elaboration after assessment or in response to student questions.

These are in keeping with Hammond and Gibbons (2015) on scaffolding and Hattie and Clarke (2019) on the importance of formative feedback to deepen learning. In sum, an interactive approach to video-based learning integrated with self-assessment and hands-on was expected to lead learners not passive into active engagement; visualize multidisciplinary complex pharmaceutical-related topics and create bridge between prior knowledge-transfer of same level information. These findings support constructivist and situational learning theories (Virtanen et al., 2017) by illustrating that authentic, multimodal teaching has a positive impact on the cognitive processing and collaborative learning in pharmacy education.

Table 3
Wilcoxon Signed-Rank Test for Pre-and-Post Test

Coverage	W	z	p	Interpretation
Prelim	1124.0	-8.71	<.01	Statistically Significant
Midterm	850.0	-9.4	<.01	Statistically Significant
Final	237.5	-9.66	<.01	Statistically Significant

The Wilcoxon Signed-Rank Test performed to compare the pre-test and post-test scores for Prelim, Midterm and Final coverage are presented in Table 3. This suggests students' academic achievement was improved by access to authentic video material. The large post-test score improvements through all periods of the year indicate that authentic learning materials are able to improve knowledge and competence-based results. These results are consistent with Mayer's (2009) cognitive theory of multimedia learning that emphasizes the beneficial impacts of dual-channel processing for spoken and visual information on retention and understanding. Structured, situationally appropriate regulated input delivered via video resources optimized learning efficiency. The continuous advances also tend to lend support to Herrington and Oliver (2000) and Lombardi (2007) who suggest that students in authentic, real-world contexts are better able to pursue knowledge as well as applied skill development which is central for competency-based education. Also of note is the difference between successes at the Prelim versus maintaining that advantage to the Final, which points toward repeated exposure strengthening long-term retention, in a manner consistent with Bransford et al. (2000) on the advantages of spaced practice in complex learning domains. Observed instructional strategies—such as recap sessions and post-assessment discussions—mirror Vygotsky's (1978) concept of scaffolding, providing learners with just enough support to advance beyond their current level of understanding. Similarly, the inclusion of pre-test and post-test assessments as part of the formative tools were consistent with Biggs and Tang (2011) focused on an alignment of evaluation approaches to course learning outcomes. The combined results of the study offer empirical support that authentic video-based instruction resources not only enhance students' academic performance, but also cultivate skills in competencies in pharmaceutical education. This points to their efficacy as technology-mediated pedagogical artifacts mediating between theoretical activity and that of professional practice.

From the teachers' perceptions of the relevance and influence of animation-based learning materials in readying pupils for real-world pharmacy practice, figure 3 shows the text network analysis from which the following themes were derived as given in table 4. The responses were thematically examined and grouped under three major categories: (1) pedagogical efficiency, (2) student participation, and (3) difficulties with implementation. Each theme was subsequently merged to reflect the general teaching experience of instructors in employing video-based resources in pharmacy education.

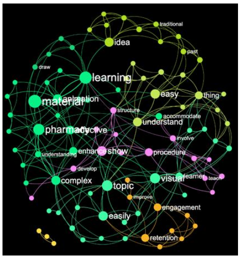


Figure 3. Pedagogical effectiveness and real-world application

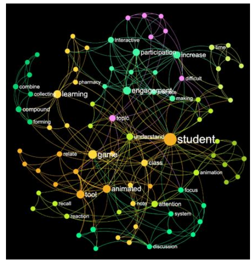


Figure 4. Student engagement and motivation

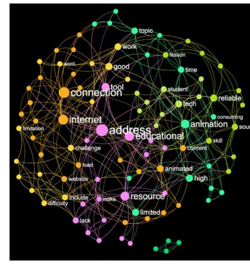


Figure 5. Implementation challenges and adaptive strategies

Pedagogical Effectiveness and Real-World Application. All instructors noted that animated educational resources afforded a better students' understanding, retention, and application of concepts related to pharmacy. Instructors explained that animations with visuals made complex processes, like biochemical reactions and the development of disorders, more concrete and could be more easily recalled during assessments. One instructor reported that animation helped students conceptualize the evolution of disorders on a step-by-step basis, which would have been very challenging to express in text. Equally important, instructors stated that animation helped students to connect theoretical concepts with real-life settings when being able to visualize how a drug interacts with receptors or how pharmacy protocols are implemented in a clinical environment. This finding validated the work of Baylen and D'Alba (2015), who indicated that authentic and visual learning supports more relevant and applicable content in practice. This is also associated with competency-based education, which prioritizes practical knowledge and readiness for real-world practice (Al-Eraky et al., 2015). Furthermore, this aligns with the cognitive theory of multimedia learning, which promotes that combining audio-visual elements helps create a deeper processing, being remembered over the long term (Mayer, 2021).

Student Engagement and Motivation. Another central theme was the increased student motivation, attention, and participation brought about by animated learning tools. Facilitators have characterized students' attention and creativity during video-based lessons as greatly unexpected, with many students' demonstrated advanced levels of interest during class discussion and lab activities. Faculty members also noted that the use of gamified video sequences and animated sequences as a vehicle to create an enjoyable and emotionally engaged learning experience for students, and ultimately served to motivate students to become more engaged in their learning. The insights from the observations were consistent with literature focusing on the affective domain of learning developmentally, and emotional engagement resulted in more prolonged academic persistence and student satisfaction. The use of animation also catered to visual and audio-visual learners, as noted by instructors who observed improved performance among students who previously struggled with text-heavy content. Such motivation and participation, when paired with real-world scenarios, contributed not only to content mastery but also to the development of professional attitudes essential for pharmacy practice (Winckel et al., 2020).

Implementation Challenges and Adaptive Strategies. Although the use of animations has many benefits, the professors did indicate some challenges they encountered in the incorporation of animations into their teaching practice. Challenges included technical problems with connectivity (i.e., internet), access to pharmacist-specific animated resources, and the increased workload and time needed to develop, search for, and integrate animations, especially for professors with large cohorts and/or teaching multiple subjects. Many professors opted to use offline downloads of the animated content, have added their content to updated sites (i.e., Microsoft, LMS), and pre-packaged content. The professors acknowledged that it is difficult to maintain a steady level of quality across multiple lessons, and students were starting to expect the same level of multimedia in every lesson. Hewitt & Muir (2020) states all of these themes came together to illustrate a transformative teaching experience for the pharmacy educators. While the animation-based tools do take time, rely on new technological pedagogy, and need careful integration into the subject course, ultimately they provided excellent worth pedagogically, student engagement and improved preparedness for pharmacy practice in the "real world". The teachers viewed these materials as not just supplements to learning, but as the main ingredient, especially when conveying potentially difficult to grasp scientific material with precision and clinical application. This experience reaffirmed the value of multimedia and animations in contemporary pharmacy education, as well as their skills and knowledge that develop practice skills needed to facilitate relevant work environments happen (Dempsey & Betts 2021; Saffari et al 2021).

Table 4

Teachers' Experience and Impact on Animation-Based Learning

Question No.1: How do you perceive the effectiveness of animation-based learning materials in enhancing students' understanding of complex pharmacy concepts?

Main Theme	Pedagogical Effectiveness and Real-World Application
Subtheme	1. Enhancement of Comprehension and Retention
	2. Support for Visual and Audio-Visual Learners
	3. Increased Student Engagement and Motivation
	4. Bridging Theory to Real-Life Application
	5. Improvement in Teaching Efficiency

Question No.2: In what ways have animated educational tools influenced student engagement, participation, or motivation in your pharmacy classes?	
Main Theme	Student Engagement and Motivation
Subtheme	1. Improved Comprehension and Recall
	2. Enhanced Student Engagement
	3. Increased Motivation and Enjoyment
	4. Real-World Relevance and Application
	5. Effective Teaching Strategy Integration
Question No.3: What challenges or limitations have you encountered when integrating animated content into your instructional strategies, and how have you addressed them?	
Main Theme	Implementation Challenges and Adaptive Strategies
Subtheme	1. Internet and Technical Connectivity Issues
	2. Limited Access to Quality Resources
	3. Instructor Workload and Time Constraints
	4. Students' Technical Readiness
	5. Need for Consistency and Integration

Three complementary learning theories, constructivist learning, situated learning and Bloom's revised taxonomy account for the integration of authentic materials into pharmacy education. From a constructivist perspective, students began with minimal to basic prior knowledge in several topics, particularly in complex areas like drug design and regulatory systems. The animated videos and the authentic case based materials served as scaffolds for activation of prior knowledge and schema construction (similar to Vygotsky, 1978; Bransford et al. (2000). This scaffolding encouraged mental effort by assisting learners in linking prior knowledge to more advanced new material. The classroom processes also demonstrated situated learning theory in action. Through exposing students to examples of practice, including ethical review processes, dossier reparation and clinical trial design, we situated learning in the tasks that corresponds with professional practice. This immersion of activity also nurtured a sense of professional identity and provided understanding, resonant with Lave and Wenger (1991) that learning occurs at its fullest when it is situated within meaningful, real activities. Last, the significant pre- and post-test gains indicated extension of learning across blooms revised taxonomy. Beyond retention and understanding, students moved to application and analysis. This discovery aligns with Anderson and Krathwohl's (2001) argument that instruction evokes the progression of learners toward more complex capabilities. Taken in combination, these results demonstrate that using authentic learning resources for pedagogy is sound in theory and brings practical benefits. Based on its ability to engage prior knowledge, facilitate situated learning and move up Bloom's ladder of complexity, this approach was shown to improve student performance in the class and their readiness for real world pharmacy practice. The theoretical synthesis of these viewpoints underscores a comprehensive evidence-based approach, which supports cognitive and competency level outcomes in pharmacy education.

CONCLUSION

This study demonstrated that animation-based authentic learning materials (ALMs) significantly enhanced pharmacy students' knowledge activation, classroom engagement, and competency-based outcomes. Students had low or modest prior knowledge about complex topics such as drug design and regulation at the outset of instruction, but became able to develop schemas and understand the advanced concepts through animation-based case studies, simulations, and dossier activities. These findings validate constructivist learning theory which emphasizes the role of prior knowledge in facilitating new learning. Student reflections and faculty observations also provided evidence that such authentic clinical and regulatory content promoted situated cognition by connecting theoretical concepts with practice. Multimedia integration through graphics, simulations, and AI-driven narration improved comprehension, aligning with cognitive theory of multimedia learning. The Wilcoxon Signed-Rank Test found statistically significant improvement across the Prelim, Midterm and Final tests suggesting that ALMs not only supported retention but also moved students through a higher depth of learning. Faculty perceptions mirrored these results, with increased teaching efficiency and student motivation being reported despite logistical challenges. In conclusion adoption of real video-based learning resources is conceptually sound and practically useful, adding a comprehensive pedagogical tool to the repertoire educators can use when preparing pharmacy students for complex practice in the real world

RECOMMENDATION

Pharmacy educators are recommended to use animation-based authentic learning resources as integral teaching methods, particularly in their potential of boosting prior knowledge engagement, applied skills acquisition and evidence based competencies. Schools of pharmacy must offer training and technical support to faculty members to address implementation challenges so that the inclusion of multimedia in curricula is sustained. Additional studies are warranted to extend the use of ALMs throughout various health science programs and assess their long-term effect on readiness for professional practice and performance in real-world settings.

TRANSLATIONAL RESEARCH

The results of this study can be easily translated into an educational setting, as this investigation supports that animated-based authentic learning materials offer benefits not only to students' cognitive outcomes but also to applied professional skills relevant to pharmacy practice. These materials offer a scalable, evidence-based teaching tool for inclusion inside pharmacy and other health sciences school curricula by linking academic learning to real-world application. Outside of school, the approach fosters workforce readiness when used to prepare future pharmacists with the ability to make decisions, understand routine and emergency regulations, and solve problems in order to care for patients better by delivering enhanced health services and improving professional performance.

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