NARRATIVE REVIEW

Storytelling in teaching-learning in physiology: opportunity, challenges, and harnessing newer platforms and artificial intelligence

Himel Mondal[1,*], Shaikat Mondal[2]
[1]Department of Physiology, All India Institute of Medical Sciences, Deoghar, India
[2]Department of Physiology, Raiganj Government Medical College, India
[*]All India Institute of Medical Sciences, Deoghar, INDIA,
Email: himel.physiology@aiimsdeoghar.edu.in
Tel: +919830293119

Storytelling is an age-old craft of weaving narratives that form one of the most fundamental forms of human expression. Currently, it is being explored for medical education. Implementing storytelling in pre-clinical subjects like Physiology poses challenges due to its content being primarily at the molecular level. Distinguishing storytelling from traditional methods, this article explores the scientific evidence supporting the advantages, such as increased student engagement and comprehension, and challenges, including potential resistance from educators and concerns about scientific accuracy. Evidence-based strategies are proposed to mitigate these challenges, encompassing faculty development programs. Furthermore, this article discusses the potential role of large language models in crafting scientifically accurate and engaging storytelling sessions. Backed by evidence supporting its potential for wider reach and collaborative learning, social media may be an appealing platform for storytelling. Addressing the multimedia aspect, the article discusses essential hardware and software tools for creating visually appealing educational content, acknowledging diverse learning preferences. Hence, this article provides an evidence-based insight into effectively harnessing storytelling in physiology teaching.

Keywords: Multimedia, Social media, Medical education, Students, Faculty, Physiology

استخدام السرد القصصي في عملية التعليم والتعلم في علم وظائف الأعضاء: الفرص والتحديات، وتوظيف المنصات الحديثة والذكاء الاصطناعي

يُعدّ سرد القصص فنًا عريقًا في نسج الحكايات، وهو يُشكّل أحد أهمّ أشكال التعبير الإنساني. ويجري حاليًا استكشافه في مجال التعليم الطبي. ويُمثّل تطبيق سرد القصص في المواد ما قبل السريرية، كعلم وظائف الأعضاء، تحديًا نظرًا لتركيز محتواها بشكل أساسي على المستوى الجزيئي. وبتمييز سرد القصص عن الأساليب التقليدية، تستكشف هذه المقالة الأدلة العلمية التي تدعم مزاياه، مثل زيادة تفاعل الطلاب وفهمهم، والتحديات التي يواجهها، بما في ذلك احتمالية مقاومة المعلمين والمخاوف بشأن الدقة العلمية. وتقترح المقالة استراتيجيات قائمة على الأدلة للتخفيف من هذه التحديات، بما في ذلك برامج تطوير أعضاء هيئة التدريس. كما تناقش المقالة الدور المحتمل لنماذج اللغة الكبيرة في تصميم جلسات سرد قصص دقيقة علميًا وجذابة. وبفضل الأدلة التي تدعم إمكانية الوصول إلى نطاق أوسع والتعلم التعاوني، قد تُشكّل وسائل التواصل الاجتماعي منصة جذابة لسرد القصص. وبالحديث عن جانب الوسائط المتعددة، تناقش المقالة الأدوات الأساسية من الأجهزة والبرامج لإنشاء محتوى تعليمي جذاب بصريًا، مع مراعاة تنوّع أساليب التعلم. لذا، تُقدّم هذه المقالة رؤيةً قائمةً على الأدلة حول كيفية توظيف أسلوب سرد القصص بفعالية في تدريس علم وظائف الأعضاء.

الكلمات المفتاحية: الوسائط المتعددة، وسائل التواصل الاجتماعي، التعليم الطبي، الطلاب، أعضاء هيئة التدريس، علم وظائف الأعضاء

فیزیولوجی کی تدریس و تعلم میں کہانی گوئی: مواقع، چیلنجز، اور جدید پلیٹ فارمز و مصنوعی ذہانت کا استعمال

کہانی سنانے کی داستانوں کو بُننے کا ایک قدیم ہنر ہے جو انسانی اظہار کی سب سے بنیادی شکلوں میں سے ایک ہے۔ فی الحال، طبی تعلیم کے لیے اس کی تلاش کی جا رہی ہے۔ فزیالوجی جیسے پری کلینیکل مضامین میں کہانی سنانے کو لاگو کرنا اس کے مواد کے بنیادی طور پر مالیکیولر سطح پر ہونے کی وجہ سے چیلنجز کا سامنا کرتا ہے۔ کہانی سنانے کو روایتی طریقوں سے ممتاز کرتے ہوئے، یہ مضمون فوائد کی حمایت کرنے والے سائنسی شواہد کی کھوج کرتا ہے، جیسے طلباء کی بڑھتی ہوئی مصروفیت اور فہم، اور چیلنجز، بشمول اساتذہ کی ممکنہ مزاحمت اور سائنسی درستگی کے بارے میں خدشات۔ ان چیلنجوں کو کم کرنے کے لیے ثبوت پر مبنی حکمت عملی تجویز کی گئی ہے، جس میں فیکلٹی ڈویلپمنٹ پروگرام شامل ہیں۔ مزید برآں، یہ مضمون سائنسی طور پر درست اور دل چسپ کہانی سنانے کے سیشنوں کو تیار کرنے میں بڑے زبان کے ماڈلز کے ممکنہ کردار پر بحث کرتا ہے۔ وسیع تر رسائی اور باہمی تعاون کے ساتھ سیکھنے کی صلاحیت کی حمایت کرنے والے شواہد کے ذریعے، سوشل میڈیا کہانی سنانے کے لیے ایک پرکشش پلیٹ فارم ہو سکتا ہے۔ ملٹی میڈیا پہلو پر توجہ دیتے ہوئے، مضمون میں متنوع سیکھنے کی ترجیحات کو تسلیم کرتے ہوئے، بصری طور پر دلکش تعلیمی مواد بنانے کے لیے ضروری ہارڈویئر اور سافٹ ویئر ٹولز پر بحث کی گئی ہے۔ لہذا، یہ مضمون فزیالوجی کی تعلیم میں کہانی سنانے کو مؤثر طریقے سے استعمال کرنے کے لیے ثبوت پر مبنی بصیرت فراہم کرتا ہے۔

کلیدی الفاظ: ملٹی میڈیا، سوشل میڈیا، طبی تعلیم، طلباء، فیکلٹی، فزیالوجی

قصه‌گویی در فرایند آموزش و یادگیری فیزیولوژی: فرصت‌ها، چالش‌ها و بهره‌گیری از پلتفرم‌های نوین و هوش مصنوعی

قصه گویی هنری کهن است که در آن روایت‌ها بافته می‌شوند و یکی از بنیادی‌ترین شکل‌های بیان انسانی را می‌سازند. امروزه کاربرداین روش در آموزش پزشکی در حال بررسی است. به‌کارگیری قصه‌گویی در دروس پیش‌بالینی مانند فیزیولوژی با چالش‌هایی همراه است، زیرا محتوای این دروس عمدتاً در سطح مولکولی است. این مقاله ضمن تمایز قصه‌گویی از روش‌های سنتی، شواهد علمی مؤید مزایای آن، از جمله افزایش مشارکت و درک دانشجویان، و نیز چالش‌های آن، از جمله مقاومت احتمالی اساتید و نگرانی‌ها درباره دقت علمی، را بررسی می‌کند. برای کاهش این چالش‌ها راهبردهای مبتنی بر شواهد از جمله برنامه‌های توسعه اعضای هیئت علمی، پیشنهاد شده است. افزون بر این، مقاله نقش بالقوه مدل‌های زبانی بزرگ را در تدوین جلسات قصه‌گویی دقیق از نظر علمی و جذاب مطرح می‌کند. شبکه‌های اجتماعی نیز که شواهدی از توان آن‌ها برای دسترسی گسترده‌تر و یادگیری مشارکتی وجود دارد، می‌توانند بستر مناسبی برای قصه‌گویی باشند. مقاله با توجه به جنبه چندرسانه‌ای، ابزارهای سخت‌افزاری و نرم‌افزاری ضروری برای تولید محتوای آموزشی جذاب از نظر بصری را با در نظر گرفتن سبک‌های یادگیری متنوع بررسی می‌کند. بنابراین، این مقاله بینشی مبتنی بر شواهد درباره چگونگی بهره‌گیری مؤثر از قصه‌گویی در آموزش فیزیولوژی ارائه می‌دهد.

واژه های کلیدی: چندرسانه‌ای، رسانه‌های اجتماعی، آموزش پزشکی، دانشجویان، اساتید، فیزیولوژی

INTRODUCTION

Storytelling, the age-old craft of weaving narratives, stands as one of the most fundamental and enduring forms of human expression. From ancient oral traditions to modern digital platforms, stories have transcended time and culture, serving as vessels for the transmission of knowledge, culture, and shared human experiences. Whether through spoken word, written text, visual imagery, or a combination of media, storytelling has a unique ability to captivate and resonate across diverse audiences (1).

The roots of storytelling stretch deep into the annals of history, where ancient civilizations used narratives to pass down cultural, moral, and practical knowledge. Over time, storytelling has evolved in response to societal changes and technological advancements. What once echoed around campfires has found new avenues in books, films, podcasts, and digital media (2). Cognitive science affirms that storytelling activates various regions of the brain, enhancing comprehension, retention, and emotional engagement.

The utilization of storytelling in education is not a novel concept. Throughout history, medical educators have employed narratives to pass down knowledge from one generation to the next. However, its planned integration into medical education has gained momentum in recent years (3). The evolution of medical education recognizes the significance of not only imparting factual information but also instilling a sense of context and relevance. Storytelling emerges as a dynamic method to achieve this balance (4).

The rationale for incorporating storytelling in Physiology education extends beyond mere entertainment. It aligns with the educational philosophy that learning is an active, participatory process. By providing students with narratives that evoke emotion, curiosity, and critical thinking, educators create an environment where the assimilation of knowledge becomes an immersive and memorable experience (5).

In this context, this article describes various facets of storytelling in physiology education, including its advantages, pitfalls, challenges, and mitigation strategies. It also explores the role of large language models and the integration of social media into physiology storytelling.

Types

Storytelling in medical education can be categorized into several types. Clinical case-based storytelling includes case-based learning, where students discuss differential diagnoses, and problem-based learning, where they explore diseases based on symptoms. Reflective and humanistic storytelling involves narratives from physicians sharing personal experiences, student reflections on clinical encounters, and patient-driven stories. Experiential and simulation-based storytelling includes simulation exercises, such as managing a cardiac arrest scenario, and ethical dilemmas, where students debate medical decisions like respecting patient autonomy. Educational and conceptual storytelling incorporates historical narratives, metaphors, and digital storytelling, such as animations illustrating disease progression. These storytelling methods are shown in Table 1, and their use depends on the subject, topic, and teaching methods.

Anatomy of storytelling

Before describing the structure and components of a storytelling session, let us read a story first, available in Annexure 1. Now, if we dissect the story into various components, we will have 10 major components briefed in Table 2.

A storytelling session is a carefully constructed narrative designed to inform, engage, and resonate with its audience, built upon a structured framework of interrelated components. At its core are the characters, the driving forces of the story - be it a patient, healthcare professional, or even molecular elements - that provide relatability and emotional depth. The setting establishes the environment, whether it is a physical location like a hospital or a biological system like an organ, anchoring the narrative in a realistic or scientific context. The conflict or challenge introduces the central issue, such as a medical condition or physiological struggle, creating tension and purpose. This unfolds through the plot, a sequential narrative arc that navigates the problem's onset, diagnosis, and eventual resolution. The resolution offers closure, highlighting how the conflict is addressed, often through treatment or adaptation. A unifying theme runs throughout the session, delivering a broader message about resilience, science, or the human experience. The story is enriched with emotion, evoking empathy or inspiration, and dialogue, which communicates critical information and fosters connection. Descriptive visual elements and analogies simplify complex concepts, making the story vivid and accessible. Finally, interactive elements engage the audience actively, encouraging them to reflect, predict, or participate, transforming the storytelling session into an impactful learning experience.

Divergence from traditional learning

In medical education, storytelling represents a notable divergence from conventional didactic methods, ushering in a paradigm shift that transcends traditional pedagogical boundaries. Unlike the traditional approach, which often relies on lectures and rote memorization, storytelling introduces a dynamic and engaging narrative format. This departure from the passive reception of information transforms the learning experience into an active and participatory endeavor (6).

Through storytelling, educators create a vibrant

Table 1. Category and type of storytelling with examples

Category	Type	Example
Clinical case-based	Case-based	A 60-year-old man with chest pain is brought to the emergency room. Students discuss differential diagnoses, leading to myocardial infarction, GERD, and panic attacks.
	Problem-based learning	A traveler returning from South America develops fever and joint pain. Students explore possible infections like dengue, chikungunya, or malaria.
Reflective & humanistic	Narratives	A doctor shares their experience of comforting a terminally ill patient's family, highlighting the emotional challenges of palliative care.
	Personal reflections	A medical student reflects on their first time witnessing a difficult patient-doctor interaction and how it shaped their communication skills.
	Patient-driven stories	A stroke survivor recounts their journey through rehabilitation, emphasizing the importance of persistence and multidisciplinary care.
Experiential & simulation-based	Simulation-based	Students participate in a simulated code blue scenario where they must manage a patient in cardiac arrest, practicing teamwork and resuscitation protocols.
	Ethical dilemma narratives	A patient refuses a life-saving blood transfusion. The class debates how to respect patient autonomy while addressing medical responsibility.
Educational & conceptual	Historical narratives	The discovery of insulin by Banting, Best, Macleod, and Collip transformed diabetes from a fatal disease to a manageable condition.
	Metaphorical storytelling	Explaining the immune system as a military defense system, where white blood cells act as soldiers, and vaccines as training exercises.
	Digital storytelling	An interactive animation showing how atherosclerosis develops, leading to heart disease, with a visual breakdown of cholesterol buildup and plaque formation.

Table 2. Components of a story used for educational purposes

Component	Brief description	Examples from Maya's story
Characters	The main person (patient, healthcare professional, or even cellular/molecular elements) and supporting cast involved in the story. Example: A patient struggling with symptoms.	Maya (teacher with symptoms), Dr. Naskar (neurologist), autoantibodies, acetylcholine, neuromuscular junctions.
Setting	The physical or biological environment where the story unfolds. Example: A hospital, a classroom, or an organ or system.	Physical: Classroom, stairs, clinic. Biological: Neuromuscular junctions.
Conflict/Challenge	The central medical problem or challenge being faced. Example: Symptoms experienced by the patient, the progression of a disease, or the battle between normal physiology and pathological mechanisms.	Drooping eyelids, muscle weakness, difficulty climbing stairs/chewing; autoantibodies attacking acetylcholine receptors.
Plot	The sequence of events in the story, from the onset of the problem to its resolution. This includes the presentation of symptoms, diagnosis, and treatment process.	Onset of symptoms → seeking help → diagnosis via edrophonium test → treatment plan → adaptation and recovery.
Resolution	How the conflict is managed or resolved. Example: The implementation of a treatment plan, lifestyle changes, or scientific breakthroughs.	Diagnosis confirmed; treatment with pyridostigmine, immunosuppressants, and lifestyle changes. Improvement in symptoms.
Theme	The underlying message or moral of the story, often emphasizing resilience, the importance of early diagnosis, or the value of medical science.	Resilience in illness; importance of seeking timely medical care; medical science enabling effective disease management.
Emotion	The feelings evoked through the story. Example: The patient's frustration, fear, or relief; the doctor's empathy; or the hope provided by effective treatment.	Maya's fear, frustration, and relief; Dr. Naskar's empathy; hope from effective treatment and adaptation.
Dialogue	Conversations between characters that convey information or emotions. Example: A doctor explaining a diagnosis or a patient describing their symptoms.	Maya describing symptoms; Dr. Naskar explaining the disease mechanism (lock-and-key analogy) and treatment options.
Visual/Descriptive Elements	Imagery or analogies used to help the audience visualize complex medical concepts. Example: Comparing a blocked artery to a clogged pipe or depicting cellular interactions as a battle.	Eyelids "weighed down by invisible chains"; neuromuscular junction as a "lock-and-key" system; the "battle" in her body.
Interactive Elements	Engagement tools to involve the audience. Example: Asking questions, encouraging predictions, or using quizzes or thought experiments related to the story.	Not explicitly interactive but encourages readers to visualize and empathize with Maya's condition.

environment woven into relatable narratives, offering students an immersive experience that extends beyond the confines of textbooks and lectures. By fostering an environment where

students are emotionally and intellectually invested in the subject matter, storytelling not only enhances comprehension but also sparks a genuine interest in the intricacies of the subject (7).

In this era of educational innovation, the divergence from traditional learning to storytelling in physiology education emerges as a compelling catalyst for transformative and engaging learning experiences (8, 9). Table 3 presents comparative aspects between traditional learning and storytelling.

Table 3. Comparison between storytelling and traditional teaching-learning

Domain	Storytelling	Traditional learning
Approach to content delivery	Engages learners through narrative formats, weaving medical concepts into stories.	Primarily relies on lectures, textbooks, and rote memorization for content delivery.
Engagement level	Promotes active learning, encouraging students to participate, think critically, and connect with the material emotionally.	Tends to be more passive, with students receiving information through lectures and readings without active involvement.
Memory retention	Enhances memory retention by leveraging cognitive processes activated through storytelling.	Relies on repetition and memorization techniques without necessarily capitalizing on emotional and narrative elements.
Real-world context	Provides a contextual framework by placing medical concepts within relatable narratives, bridging theory and real-world applications.	Often presents information in a more abstract manner, which may not immediately resonate with real-world scenarios.
Student interaction	Fosters student interaction and collaboration, as narratives often prompt discussions and critical thinking exercises.	Interaction is often limited to traditional classroom settings, with fewer opportunities for collaborative learning.
Motivation and interest	Sparks genuine interest by making the subject matter more engaging and relatable, motivating students to explore further.	Motivation may rely more on external factors, and interest might wane without a dynamic and engaging approach.
Flexibility and adaptability	Offers flexibility in adapting content to diverse learning styles, allowing for a more personalized and inclusive approach.	May have a more rigid structure, potentially limiting adaptability to individual student needs.
Teacher-student relationship	Fosters a more dynamic teacher-student relationship as educators become storytellers and facilitators of discussion.	Often characterized by a more traditional hierarchy, with teachers serving as primary information providers.
Critical thinking skills	Cultivates critical thinking skills by prompting students to analyze, question, and draw connections within the narrative context.	While critical thinking is encouraged, it may not be as explicitly emphasized in traditional teaching methods.

Advantages

Storytelling in physiology education contributes to increased learning through various mechanisms that engage learners both cognitively and emotionally. Key ways in which it enhances the learning process are summarized in Figure 1 (10-12).

By embedding concepts within narratives, storytelling provides a context that helps students relate abstract ideas to real-world scenarios. It has the potential to help students think critically as they analyze characters, plot developments and the application of principles within the narrative. In addition to subject matter, a story also evokes emotions, making the learning experience more memorable and impactful. Hence, a multisensory engagement is there, and it can help in improved memory retention. Along with the story, teachers can use audiovisual and role play, which is a combination of visual, aural, read, and kinesthetic components that is suitable for a diverse range of learners. Furthermore, students can connect with the material on an individual level, finding resonance with characters or scenarios that align with their own experiences or interests.

Hence, storytelling can foster learning by creating an emotionally engaging, context-rich, and memorable educational experience.

Disadvantages

Like all other educational tools or methods, storytelling has both advantages and disadvantages. Understanding these disadvantages is crucial for educators and curriculum designers to implement storytelling judiciously in medical education. Key disadvantages are summarized in Figure 2 (13-15).

Developing well-crafted narratives demands a considerable investment of time. In the context of a comprehensive medical curriculum, educators may find it challenging to strike a balance between the time spent on storytelling and the need to cover a broad range of medical topics adequately. Therefore, traditionalists within the medical education community may resist the shift from conventional teaching methods to narrative approaches. There is always a risk of overemphasizing entertainment at the expense of educational content. If storytelling prioritizes engaging narratives over the delivery of accurate medical information, it may compromise the academic rigor essential for medical education. In addition, there is a potential for conveying inaccurate or incomplete medical information to the intended audience. Different learners may interpret narratives in divergent ways, potentially leading to variations in understanding medical scenarios. The subjective nature of storytelling introduces a level of ambiguity that may not align with the precision

Figure 1. Major advantages of storytelling as an educational tool

Figure 2. Major disadvantages of storytelling as an educational tool

often required in medical education. Crafting narratives involving sensitive medical scenarios may raise ethical concerns. Balancing the need for realism in storytelling with the ethical considerations of patient confidentiality, privacy, and sensitivity requires careful navigation by educators.

Understanding the advantages and disadvantages of incorporating storytelling as an educational tool is paramount for informed decision-making. Instructors need to make an informed choice (Figure 3). Balancing educational rigor with engagement is essential, where well-crafted narratives combining both can enhance learning outcomes, while overly simplistic stories or engaging but inaccurate content may compromise educational value.

Challenges and potential solutions in physiology

Creating compelling stories in preclinical medical subjects like Physiology presents a unique set of challenges. The subject, which delves into the fundamental mechanisms of the human body in

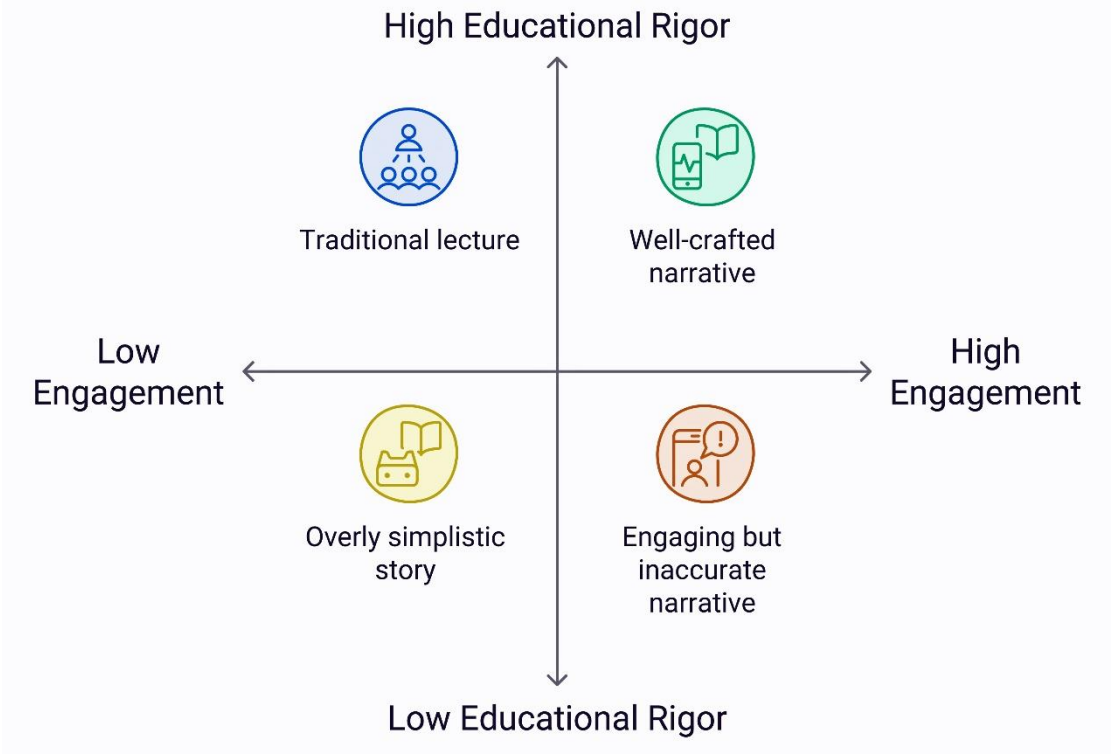

Figure 3. Balance between educational rigor and engagement in storytelling

normal conditions, may initially seem less amenable to narrative approaches. The challenges a medical teacher may face in incorporating storytelling and potential solutions to mitigate those challenges are summarized in Table 4.

Table 4. Challenges and potential solutions of implementing storytelling in physiology

Challenge	Potential solution
Abstract nature of content	Analogies and metaphors can be employed to translate complex physiological processes into narrative elements that students can grasp more easily.
Lack of dramatic events	Educators can focus on highlighting the inherent drama in the precision and balance of physiological processes.
Potential for monotony	To overcome potential monotony, educators can explore diverse perspectives, historical contexts, or the evolutionary significance of physiological mechanisms.
Limited patient interaction in first-year	Educators can incorporate stories of patient interaction through storytelling.
Entertainment versus accuracy	Educators need to ensure that the narrative elements enhance comprehension without compromising the scientific integrity of the information.

Communicating abstract physiological concepts in storytelling poses a unique challenge that necessitates creative strategies. Crafting narratives with analogies and metaphors can render complex cellular and molecular processes more tangible for students. Despite the potential lack of dramatic events in preclinical subjects, educators can emphasize the inherent drama in the precision and balance of physiological processes, highlighting the intricacies within the body. Addressing potential monotony, educators can explore diverse perspectives, historical contexts, and evolutionary significance to add depth to the narrative. While limited patient interaction may be a constraint, educators can indirectly incorporate patient narratives to illustrate the role of normal physiology in healthcare practices. Balancing entertainment and accuracy is crucial, ensuring that narrative elements enhance comprehension without

compromising scientific integrity. Finally, historical context can be seamlessly integrated into the curriculum, offering a backdrop for understanding the development of physiological knowledge and connecting it with contemporary understanding. For example, the classical conditioning experiment by Pavlov can be both interesting and informative to the students.

By addressing these challenges creatively, educators can harness the power of storytelling in preclinical medical subjects like Physiology. While the narrative approach may require adaptation, it offers a valuable tool for enhancing student engagement, promoting understanding, and fostering a deeper appreciation for the intricacies of normal physiological functioning.

Applying storytelling

Implementing storytelling in teaching-learning in Physiology may pose challenges during the initial phases. In settings where storytelling is newly being incorporated, the teachers may undergo a training session before starting to create the stories. Here are steps that teachers can take to effectively integrate storytelling into medical education (Figure 4) (16-18).

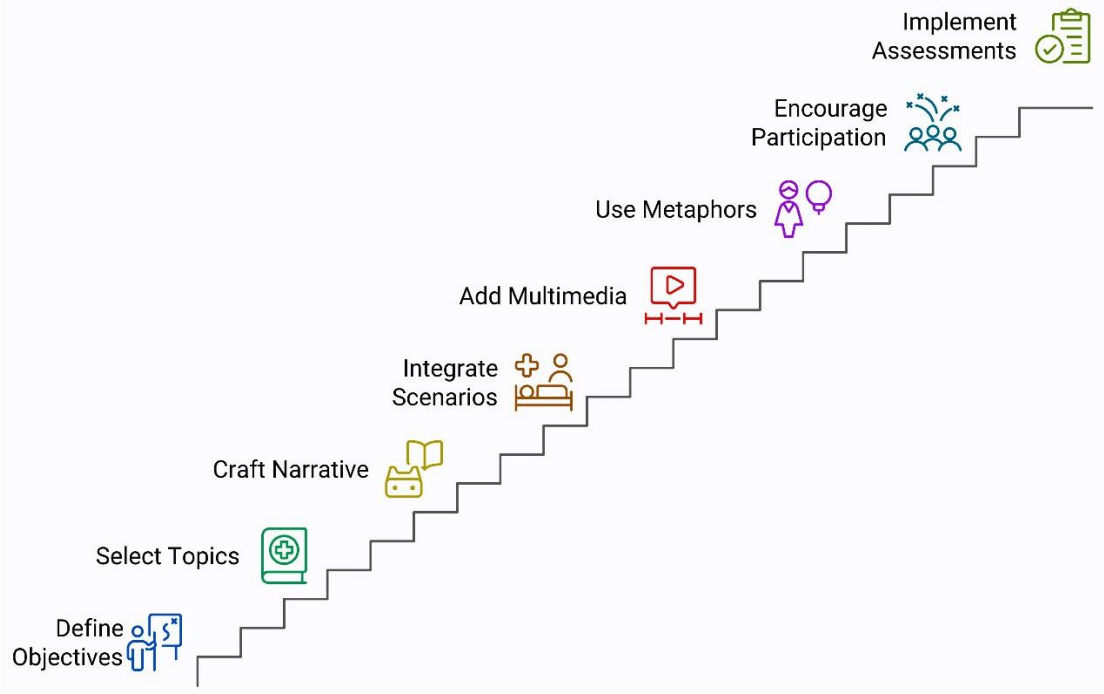

Figure 4. Steps to integrate storytelling into medical education

It is crucial to clearly define learning objectives related to the specific topic and the needs of the learner. The selection of appropriate topics, such as complex medical concepts and case studies, is vital for narrative success. The next step is crafting a compelling narrative with well-developed characters, settings, and plot elements that capture students' attention and reinforce learning objectives. Real-world medical scenarios should be seamlessly woven into the narratives to bridge theoretical knowledge with practical applications, enhancing content relevance. Integration of multimedia elements, such as images and videos, enhances the overall storytelling experience. Metaphors and analogies simplify complex concepts, promoting better understanding. Balancing entertainment and education is key, ensuring engagement without compromising scientific integrity. Encouraging student participation through interactive elements, discussions, reflections, and group activities enhances the learning experience. Feedback from students is valuable for refining future narratives promoting inclusivity by incorporating diverse perspectives. Additionally, implementing assessments, including quizzes, case studies, and practical applications, helps gauge students' understanding. Researching the acceptance and experiences of teachers contributes to ongoing improvements. Training educators based on research findings ensures consistency in the storytelling method's implementation across different instructors within the medical college.

Artificial intelligence in storytelling

Free Large language models (LLMs), such as ChatGPT, Claude, DeepSeek, Perplexity, etc., can be valuable tools for medical teachers looking to incorporate storytelling into their teaching methods. These generative artificial intelligence programs

can help in multiple steps in designing stories for teaching purposes (19, 20). Table 5 lists some of the potential uses of LLMs in storytelling.

Table 5. Potential usage of large language models in storytelling session planning and designing

Domain	Brief
Content generation	Large language models can assist in generating compelling and accurate narratives related to medical concepts.
Scenario creation	Teachers can use language models to create realistic but fabricated clinical scenarios or patient cases for storytelling.
Customization for different audiences	Language models allow for the customization of narratives to suit different audiences, such as medical students, residents, or healthcare professionals.
Multimodal content integration	Language models can assist in integrating multimedia elements (charts or tables) into the storytelling process.
Creating analogies and metaphors	Teachers can leverage language models to generate analogies and metaphors that simplify complex medical concepts.
Generating interactive elements	Language models can assist in creating interactive elements within the narrative, such as branching storylines or decision points.
Adapting narratives for different learning styles	By understanding the preferences and learning styles of students, teachers can use language models to adapt narratives to better suit visual, auditory, or kinesthetic learners, creating a more inclusive learning experience.
Assessment support	Language models can aid in generating assessment materials, such as quiz questions or case study scenarios, that align with the content presented through storytelling.
Consistency across educators	Teachers can use language models to maintain consistency in the storytelling approach across different educators within a medical institution (follow predefined guidelines).

They can help in content generation by assisting teachers in creating compelling narratives related to medical concepts. Teachers can input key information, and the models can expand on it, producing detailed and context-rich stories. Language models also aid in scenario creation, allowing teachers to fabricate realistic clinical situations or patient cases with developed characters and event progressions. These models facilitate customization for different audiences, enabling teachers to tailor the complexity and detail of storytelling based on the audience's knowledge and experience. The versatility of LLMs enhances the overall effectiveness and engagement in medical education storytelling sessions and helps cut short the invested time of the teachers.

It is important to note that while LLMs can be powerful tools, they should be used as aids to support teachers rather than replace the educator's expertise. Teachers should review and refine the generated content to ensure accuracy, relevance, and alignment with educational objectives. Additionally, ethical considerations and patient privacy must be taken into account when creating medical scenarios or content.

Social media and storytelling

Storytelling in social media offers a myriad of benefits that contribute to a dynamic and engaging learning experience. The succinct and visually compelling nature of storytelling aligns seamlessly with the fast-paced and interactive environment of social media platforms. Through narratives, educators can convey complex concepts in a relatable and digestible format, capturing the audience's attention and fostering a deeper understanding of the subject matter (21). The use of multimedia elements, such as images, videos, and infographics, enhances the storytelling experience, catering to diverse learning styles. In addition, social media's interactive features, such as comments, likes, and shares, facilitate immediate feedback and encourage collaborative discussions, transforming learning into a communal experience. Furthermore, social media is an open space where a student may feel comfortable taking part in learning at their own pace. This may also help reduce the barriers between educators and learners and foster a sense of community. In the context of medical education, where complex information abounds, storytelling on social media can bridge the gap between expertise and accessibility, making

learning not only informative but also engaging and enjoyable.

When recording and sharing educational content, particularly on social media, teachers should consider several crucial points to ensure effectiveness, respectfulness, and compliance with ethical and legal standards. Table 6 summarizes the considerations that may be followed by the medical teacher or content creator (22, 23).

Table 6. Considerations for using social media for storytelling

Considerations	Brief
Privacy and consent	Obtain explicit consent from students or individuals involved. Ensure comfort and respect privacy rights.
Maintain professionalism	Present oneself professionally. Dress appropriately, use clear language, and adhere to ethical standards for a diverse audience.
Compliance with educational policies	Familiarize with institutional policies on content creation and sharing. Align recordings with these policies to avoid violations.
Accuracy and evidence-based content	Ensure content accuracy, evidence-based information, and alignment with educational standards. Provide proper references or citations.
Engaging presentation	Create engaging recordings that capture attention. Utilize visuals, interactive elements, or storytelling techniques to enhance the learning experience.
Accessible content	Ensure content accessibility for a diverse audience. Add subtitles, provide transcripts, and use clear visuals to accommodate various learning styles.
Respect copyright and intellectual property	Avoid using copyrighted materials without permission. Provide proper attribution and adhere to fair use or legal frameworks for external resources.
Moderate comments and interactions	Be prepared to moderate interactions on social media platforms. Establish guidelines for respectful discourse and address inappropriate behavior promptly.
Regularly review and update content	Periodically review recorded content to ensure relevance and accuracy. Update or create new content as needed to keep information current.
Interactive elements	Encourage audience interaction with questions, polls, or discussions. Foster engagement and create a sense of community around educational content.
Optimize for different platforms	Tailor content to suit the platform being used. Consider varying video length preferences, aspect ratios, and audience expectations for optimization.
Consider audience demographics	Be mindful of the audience's demographics. Adapt content to be inclusive, culturally sensitive, and consider diverse backgrounds and perspectives.
Promote positive learning environment	Foster a positive and inclusive learning environment in recordings. Encourage collaboration, curiosity, and open-mindedness among viewers.

Remember that as an educator, your role is not just to disseminate information but also to create a positive and effective learning experience for your audience. By keeping these points in mind, you can share educational content responsibly and enhance the learning journey for your students or viewers.

Tools for social media storytelling

Creating audiovisual content for storytelling needs some basic tools (24). A good quality camera or smartphone, coupled with video editing software, enables the creation of visually compelling content, ensuring that the audience remains captivated. Incorporating external microphones improves audio quality, maintaining clarity and comprehension, a crucial aspect for sustained engagement. Graphic design tools assist in crafting visually appealing graphics, slides, or thumbnails that complement the narrative, making the content more visually stimulating. Live streaming platforms and social media scheduling tools facilitate real-time interaction and consistent delivery, respectively, fostering audience engagement over time. Analytics tools offer insights into audience preferences, enabling educators to tailor future content for maximum impact. Polling and Q&A features, along with engagement tracking tools, promote interactivity and provide immediate feedback, contributing to an engaging learning experience. In essence, these tools (24, 25), listed in Table 7, collectively empower educators to elevate the quality of their content, making it more appealing, interactive, and ultimately conducive to sustained audience engagement.

Future direction

As storytelling is newly being incorporated in many medical institutions, one key aspect to consider in future exploration is the establishment of clear guidelines for educators on the ethical use of storytelling methodologies (26). This includes guidelines on respecting patient confidentiality,

addressing sensitive topics with cultural sensitivity, and maintaining the highest ethical standards when crafting narratives. By framing ethical guidelines, educators can navigate potential pitfalls and uphold the integrity of medical education.

Moreover, the focus should be on the importance of guidelines for assessing the impact of storytelling on long-term knowledge retention. Developing standardized assessment strategies will enable educators to measure the sustained effectiveness of storytelling methods, providing valuable insights into the enduring impact on students' understanding and application of physiological concepts (27).

One area of potential exploration involves the integration of AI beyond LLMs and machine learning algorithms to enhance the personalization of storytelling. Investigating how AI can analyze individual learning patterns, preferences, and performance metrics to dynamically adapt the storytelling approach could contribute valuable insights into creating truly personalized educational experiences (28).

Another unexplored avenue is the utilization of immersive technologies, such as extended reality (XR) or virtual simulations, to simulate complex physiological scenarios. By incorporating these technologies into storytelling, educators can create realistic, hands-on experiences that bridge the gap between theoretical knowledge and practical application, fostering a deeper understanding of physiological concepts (29, 30).

Table 7. Basic tools for teachers for creating content for storytelling sessions

Tools	Brief
Camera or smartphone	A good quality camera or smartphone with a decent camera is essential for recording videos or capturing images. Clear visuals contribute significantly to the overall impact of the storytelling session.
Microphone	An external microphone can improve audio quality, ensuring that your voice is clear and easily understandable. This is particularly important for maintaining engagement in video content.
Video editing software	Software tools like Adobe Premiere Pro, iMovie, or even simpler apps like InShot can help edit and enhance video content. Editing allows you to trim, add effects, and improve the overall production quality.
Graphic design tools	Tools like Canva or BioRender can assist in creating visually appealing graphics, thumbnails, or slides that complement your storytelling content. Visual elements enhance the overall storytelling experience.
Teleprompter application	For scripted content, a teleprompter app can help you maintain a natural flow while looking directly at the camera. This ensures that your storytelling remains engaging and well-paced.
Storyboarding tools	Tools like StoryboardThat or even a simple pen and paper can aid in planning and organizing your storytelling content. Storyboarding helps ensure a logical and cohesive narrative structure.
Live streaming platforms	Platforms like Instagram Live, Facebook Live, or YouTube Live allow you to conduct live storytelling sessions. Live sessions enable real-time interaction with your audience, fostering engagement.
Social media scheduling tools	Tools like Buffer or Hootsuite can help you schedule your storytelling posts on social media platforms. This ensures a consistent and timely delivery of content, especially if you're planning a series.
Polling and Q&A features	Social media platforms often have built-in features for polling and Q&A. Utilize these features to interact with your audience, ask questions, or encourage discussions related to the storytelling content.
Analytics tools	Most social media platforms provide analytics tools that offer insights into the performance of your content. Understanding analytics can help you tailor future storytelling sessions based on audience engagement.
Virtual backgrounds or green screens	Virtual backgrounds or green screens can add a professional touch to your video content. This feature is particularly useful if you want to present content in a visually appealing and distraction-free manner.
Collaboration tools	If you're collaborating with other educators or experts, tools like Google Workspace or Microsoft Teams can facilitate communication, planning, and content creation.
Hashtag research tools	Tools like Hashtagify or RiteTag can help you research and choose relevant hashtags for your storytelling content. Hashtags increase the visibility of your content on social media.
Accessibility tools	Consider tools that enhance accessibility, such as adding subtitles or alt text to images. This ensures that your storytelling content is inclusive and reaches a wider audience.

CONCLUSION

This article discussed the transformative potential of storytelling in physiology education. While opportunities for enhanced engagement and knowledge retention are evident, content creation for a basic science subject may be one of the major challenges. The challenges can be overcome with proper planning, execution, research, and flexibility. As the medical curriculum is huge and

time is limited, storytelling may be carried out as an adjunct material shared on social media. Further integration of advanced technologies and the importance of framing guidelines provide a road map for educators. As we navigate the dynamic landscape of medical pedagogy, storytelling emerges as a promising avenue, poised to reshape the way we impart and absorb knowledge in the intricate realm of physiology.

Ethical Considerations:

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors.

Data availability

All the data related to the article is presented in the article itself.

ACKNOWLEDGMENTS

We acknowledge the use of ChatGPT-4o (OpenAI) for correction of grammar and language of the manuscript and NapkinAI for generating some components of the figure. We also thank Sarika Mondal and Ahana Aarshi for their help in the preparation of the figures for this article.

Financial Support: None.

Conflict of Interest: The authors declare no conflicts of interest.

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