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Anatomy Escapes the Classroom: A Case Study on Designing an Interactive Anatomy-Themed Escape Room Using Generative AI and Anatomage Technology

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Abstract

Gamification in anatomy and physiology education has gained traction for its ability to improve engagement and deepen content mastery. This case study explores the design and implementation of *Viva Vagus – The Last Bet*, a live anatomy escape room conducted at the National Anatomage Tournament in Las Vegas, Nevada. The experience was co-developed with ChatGPT, a generative AI (genAI) model, which supported the creation of storylines, puzzles, and immersive materials. Students navigated five anatomy-themed “casinos” to collect neural chips that were wagered in a final bet to stop the clock, escape the room, and win the game. Facilitators' observations revealed strong student engagement, problem-solving skills, and anatomical reasoning. This study demonstrates the feasibility of genAI-enhanced design in educational gamification, outlines its challenges and limitations, and offers a replicable model for immersive active learning. This case study serves as an introduction to future research on genAI-enhanced teaching strategies, highlighting the broader potential of transforming educational design, student engagement, and active learning across disciplines.

Keywords: Anatomage; anatomy; ChatGPT; escape room; experiential learning; gamification; generative AI.

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1. Introduction

Gamification and immersive learning strategies are increasingly recognized as high-impact practices in health sciences education, offering students a more engaging way to master complex anatomical content [1,2]. Among these innovative strategies, escape rooms have emerged as practical tools in medical and health sciences education. They promote essential competencies such as teamwork, clinical reasoning, communication, and systems-level problem solving [3–10]. Designed to simulate real-world clinical challenges, educational escape rooms require students to critically evaluate available information—including physical props, narrative clues, and anatomical content—and collaborate to solve time-sensitive problems [7]. Much like interprofessional healthcare teams, participants must communicate effectively, delegate responsibilities, and synthesize diverse perspectives to achieve a shared goal [8]. These experiences not only promote inter-cohort or interprofessional learning but also offer students the opportunity to observe and adopt different problem-solving strategies from their peers [8]. Under the pressure of the timed environment, students often show noticeable improvements in their verbal and nonverbal communication skills**,** an outcome that reflects the high-stakes nature of clinical practice [3,9].

Importantly, escape rooms create a contextual learning environment that encourages students to apply their theoretical knowledge to practical scenarios. This approach supports long-term knowledge retention, enhances clinical reasoning, and promotes continuous learning through experiential engagement [5,6]. Because the challenges often involve patient-centered cases, students must think empathetically and make decisions aligned with best practices in patient care [6,9]. Additionally, the gamified structure appeals to a variety of learning styles and preferences, creating an inclusive and motivating educational atmosphere that fosters both confidence and curiosity [11]. When intentionally designed [11,12,13], these activities can serve as high-impact educational tools that bridge the gap between classroom knowledge and clinical application. However, the successful development of such interactive activities often requires extensive time and creative effort from instructors.

Recent advancements in generative artificial intelligence (genAI) equip educators with powerful tools to design interactive and personalized learning experiences with greater efficiency and creativity [15,16,17]. GenAI models such as ChatGPT can streamline the development of complex, adaptive, and thematically cohesive educational activities that would otherwise be time-consuming, resource-intensive, or technically challenging to produce manually [18]. These tools provide a dynamic layer of instructional design, enabling the rapid generation of custom content, including case studies, scenario prompts, quizzes, visual aids, and even differentiated learning paths tailored to diverse student needs [15,16,17,18].

When paired with technologies like the Anatomage Table (a premier platform for high-resolution 3D anatomical visualization and virtual dissection) genAI becomes an even more impactful asset for anatomy and health sciences education [19]. The synergy between genAI and Anatomage enables the development of immersive, student-centered experiences that go beyond static presentations or traditional cadaver lab instruction. For instance, instructors can prompt genAI to create realistic clinical case narratives, integrate them with anatomically accurate table content, and scaffold learning objectives around real-time decision-making, teamwork, and spatial reasoning.

By leveraging open genAI resources such as ChatGPT, educators can produce tailored instructional materials including puzzles, dialogue-based tutorials, narrative clues, research assignments, and reflective prompts—all aligned with curated Anatomage Table datasets [17,18,19,20]. This combination supports not only a richer understanding of anatomical relationships but also encourages interdisciplinary thinking, clinical application, and engagement through active learning modalities.

Moreover, the time saved in content creation allows instructors to focus more on assessment, feedback, and student support, thereby enhancing the overall instructional environment [15,16,17]. While the Anatomage Table remains the gold standard for visual-spatial anatomy education [19], its integration with genAI [18] introduces an unmatched level of adaptability, interactivity, and pedagogical creativity to health sciences education. This convergence of technologies paves the way for future innovation in curriculum development, offering scalable models for gamified, simulation-based, or case-integrated learning across various disciplines.

2. Background and Setting

In 2025, more than 8,000 high school students participated in 44 Anatomage tournaments across the United States. Of the 2,100+ teams that competed, only the top five percent advanced to the National Tournament in Las Vegas, Nevada. These 80 elite teams, each composed of three to five students, competed for the title of National Anatomage Champion. In addition to the main competition, students had the opportunity to participate in a series of hands-on workshops led by educators and healthcare professionals. *Viva Vagus – The Last Bet*, an anatomy-themed escape room, was featured as one of these workshops. This workshop was uniquely designed by the author (event educator), who collaborated with ChatGPT and integrated content from the Anatomage Table, alongside anatomical and pedagogical expertise, to create a fully immersive, gamified learning experience. The workshop was repeated six times throughout the day. Each session included 13 to 14 teams who rotated through the escape room experience in groups, with 30 minutes allotted to complete five anatomy-themed casino challenges and submit a final "bet" to escape. This interdisciplinary use of genAI, virtual dissection technology, and instructional design exemplifies the creative potential of educational innovation in anatomy instruction.

3. Purpose and Anticipated Outcomes

This case study examines the development and implementation of *Viva Vagus – The Last Bet*, co-created by the author (event educator) in collaboration with ChatGPT and enhanced by Anatomage Table imagery to foster active learning across multiple physiological systems. The case highlights the collaborative design process, educational potential, and practical challenges associated with implementation.

Within the 30-minute activity window, the escape room aimed to promote observable student engagement through the following outcomes:

(1) active participation and visible enthusiasm for anatomy content;

(2) effective teamwork and collaborative problem-solving;

(3) real-time application of anatomical knowledge to solve puzzles; and

(4) engagement with multi-modal learning elements, including visual, kinesthetic, and narrative components.

4. Methods and Materials

4.1 Development

The development of the *Viva Vagus: The Last Bet* escape room was an iterative process that integrated gamification principles, active learning, and interdisciplinary anatomy education. The project was designed using a study guide provided to students to prepare for the National Anatomage Tournament. This approach offered an immersive, anatomically focused learning experience tailored for this event. The escape room balanced scientific rigor with student engagement, all within a high-paced, time-limited challenge environment. A variety of prompting methodologies (or an instructor/genAI collaborative version) were used in the process, such as input-output prompting [20]; chain-of-thought prompting [21]; expert prompting [22]; automatic prompt engineer [23]; generated knowledge prompting [24]; tree-of-thought prompting [25]. These tools enabled rapid iteration and personalization based on topic/content and participant characteristics. The entire development process, from initial concept to final materials, was completed in under three weeks.

4.2 Visual Materials and Image Sources

All visual materials used in the escape room were either created with the assistance of ChatGPT or directly sourced from the Anatomage Table. Activities required the identification of structures, interpretation of joint motion, and/or clinical scenarios. For this, high-resolution Anatomage Table screenshots and videos were captured and labeled to highlight specific anatomical features, phases, and values. In contrast, thematic and illustrative elements such as logos, poetic instruction cards, and metaphor-based signage were developed using language and formatting suggestions generated by ChatGPT. All physical props, lock-and-key mechanisms, and hands-on puzzle components were conceptualized and assembled by the educator. The image and language content were reviewed to ensure anatomical accuracy and alignment with the escape room's educational objectives.

5. Findings/Results

5.1 Phase 1: Conceptualization

Initial brainstorming sessions centered around key themes that would resonate with both the anatomy content and the Las Vegas setting of the national competition. Figure 1 illustrates a sequence of prompts used to design the escape room activity. Beginning with an initial idea, it is refined through follow-up prompts that emphasize a mystery narrative and group-based interactive elements. Each follow-up prompt was provided only after ChatGPT responded to the previous one, allowing the activity to evolve iteratively.

Figure 1: Example prompts used to initially develop the escape room, illustrating how the activity evolved into a group-based mystery challenge.

GenAI tools like ChatGPT are designed to maintain conversational context, which aids in producing coherent responses but can also become a limitation. As conversations progress, the model may overcommit to earlier interpretations, making it difficult to adapt when the user (in this case, the educator) shifts direction or tone [20,21,28]. Once a structure or theme is established, the model tends to persist with it, even if it no longer fits the intended goals. Errors or misinterpretations from the initial prompt can continue and compound over time [28]. In such cases, it is often more effective for users to ask the chatbot to "start over" and reframe the task. This reflects the collaborative nature of working with genAI: the user/educator plays an active role in guiding the output, often needing more detail and clarity rather than relying on vague or general prompts. In creative or

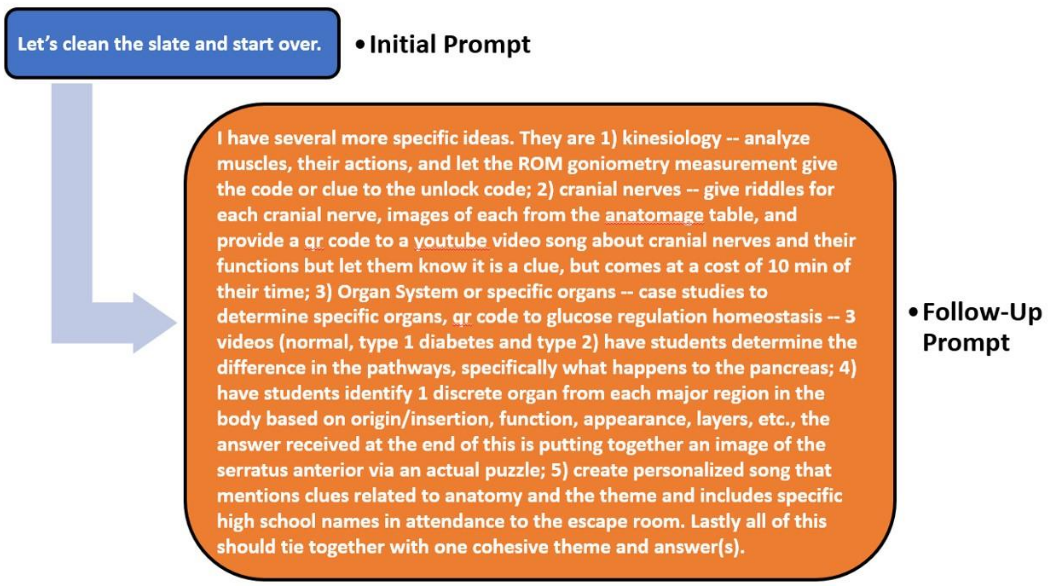


Figure 2: Resetting the conversation and using detailed, expert-informed prompts can guide genAI toward more accurate, creative, and Anatomage-aligned escape room design.

iterative work, a reset paired with detailed and specific guidance can unlock stronger, more relevant results [20,21,28]. Figure 2 demonstrates how clearing the conversational slate and providing detailed, targeted prompts can overcome genAI's tendency to cling to earlier interpretations. In specific designs such as this, the educator must draw upon in-depth knowledge of the Anatomage Table and its full range of capabilities to craft effective and accurate prompts. This enables a tailored, precise, and creative escape room. This expertise was crucial in ensuring that each prompt aligned with the Table's interactive features and anatomical accuracy, thereby allowing for a more meaningful educational experience.

While this aided in the focus of the escape room, it was minimal, as one challenge with current language models is their limited ability to consistently process and retrieve relevant information from the middle of long input contexts. Research has shown that performance tends to be strongest when key details appear at the beginning or end of a prompt, and significantly degrades when important information is placed in the middle [29]. As a result, too much information cannot be prompted at once without risking that critical content will be overlooked. This creates a practical limitation for prompting, requiring users to strategically structure or break up input to ensure the model accesses and prioritizes the correct information.

Building on the initial brainstorming and prompt refinement, the educator used these ideas to settle on a casino-themed escape room. To make the narrative more cohesive, the vagus nerve was chosen as a central unifying element due to its extensive physiological influence across multiple bodily systems [30]. This was a deliberate play on words by the educator, given the Las Vegas, Nevada setting. Framing the storyline around a "high-stakes" Vegas-style malfunction of the vagus nerve allowed ChatGPT and the educator to creatively anchor the escape room within both anatomical accuracy and thematic flair. An overall theme, *Viva Vagus: The Last Bet*, and a central question emerged: *Can you outplay the odds before the body folds?* This tagline ultimately guided much of the narrative and puzzle design. Additional prompting for image development was given to support the aesthetic of the escape room. Figure 3 showcases the escape room's themed introduction. Although the narrative and visual content in Figure 3 were generated with the help of ChatGPT, formatting them into a cohesive image or document layout is not a function the AI can perform well independently. Educators must manually cut, paste, and design the final materials using external design tools, such as Word, Canva, or PowerPoint, to produce polished and usable content.

5.2 Phase 2: Structure and Casino Design

VIVA VAGUS – THE LAST BET ESCAPE ROOM

THE STORY:

You thought you were coming to Las Vegas for the **National Anatomage Tournament**. But in the anatomical world, the real "Vegas Strip," is the wandering **Vagus Nerve** – stretching from brain to gut, pulling the strings on the body's most vital functions.

But something's gone wrong!.

During a high-profile demonstration using the **Anatomage Table**, the system experienced a catastrophic malfunction. Suddenly, every digital cadaver on display began showing alarming signs: irregular heartbeats, disrupted digestion, shaky motor control, clouded consciousness, etc...

Then, this message appeared:

"The body has bet everything on one nerve — the VAGUS. If it fails, the system collapses. You have 30 minutes to reset the core. Place your bets wisely."

YOUR MISSION:
Journey through **five physiological casinos**. You'll face high-stakes challenges inspired by real Anatomage Images and related anatomical functions.

Win each game to earn a **neural chip** — a piece of the **Vagus Nerve Stack**, the digital key needed to reboot the system. Once you've collected all **five** chips, race to the **Final Bet Table** and go **all in** to save the body before the final shutdown.

GOAL:
Reclaim vagus nerve control by completing all **five** tasks and using the knowledge gained to "reset" the body at the final command station.

Can you handle the pressure — or will the body fold?

Figure 3: The themed introduction, with content generated through ChatGPT and manually formatted by the educator.

To ensure comprehensive coverage of anatomical content in the students' tournament study guide, the escape room was divided into five thematic "casinos," each representing specific anatomical topics. The educator intentionally selected topics—such as kinesiology, homeostasis, cranial nerves, muscle, bone, and blood supply imagery—that aligned with the Anatomage Table's strongest functionalities.

Figure 3 introduces the escape room's central mission, which challenges teams to progress through the five casinos, restore vagus nerve function, and save the body before time runs out. Each casino featured unique tasks, puzzles, and embedded clues designed to reinforce learning objectives. Visual aids, including images sourced directly from the Anatomage Table and AI-generated anatomical graphics, enhanced the immersive experience while supporting targeted educational outcomes. The educator prioritized key engagement criteria: active student participation, effective teamwork and collaborative problem-solving, real-time application of anatomical knowledge, and integration of multimodal learning—visual, kinesthetic, and Vegas-themed narratives—to enhance retention and enjoyment.

5.2.1 Casino of Motion

The *Casino of Motion* was styled as *Anatomage's Got Talent.* Teams were introduced to the challenge as elite

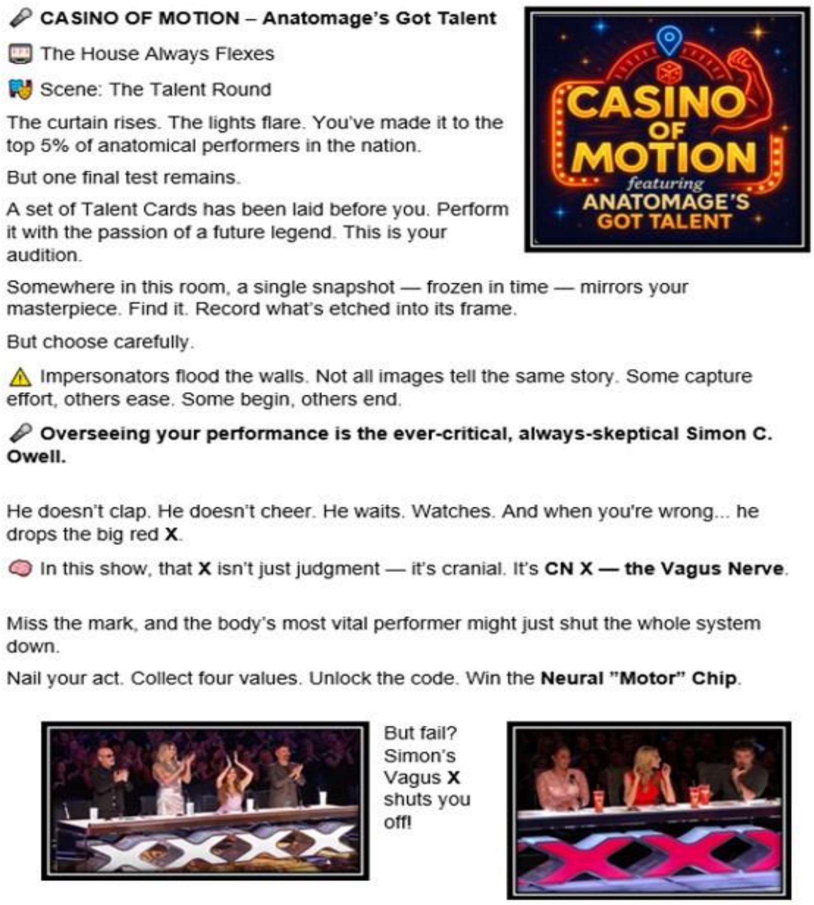


Figure 4: *Casino of Motion*, where an America's Got Talent-inspired challenge is creatively linked to the vagus nerve (CN X) through themed narrative and visuals.

performers in a high-stakes audition judged by "Simon C. Owell," trying not to receive an X—a metaphor for cranial nerve (CN) X – the vagus nerve.

This creative connection was made by the educator, drawing on the fact that *America's Got Talent* is set in Las Vegas and uses an X to eliminate contestants. Figure 4 features the written narrative and visuals for the *Casino of Motion*, where ChatGPT incorporated the educator's concept linking *America's Got Talent* and CN X to create a themed anatomical performance challenge.

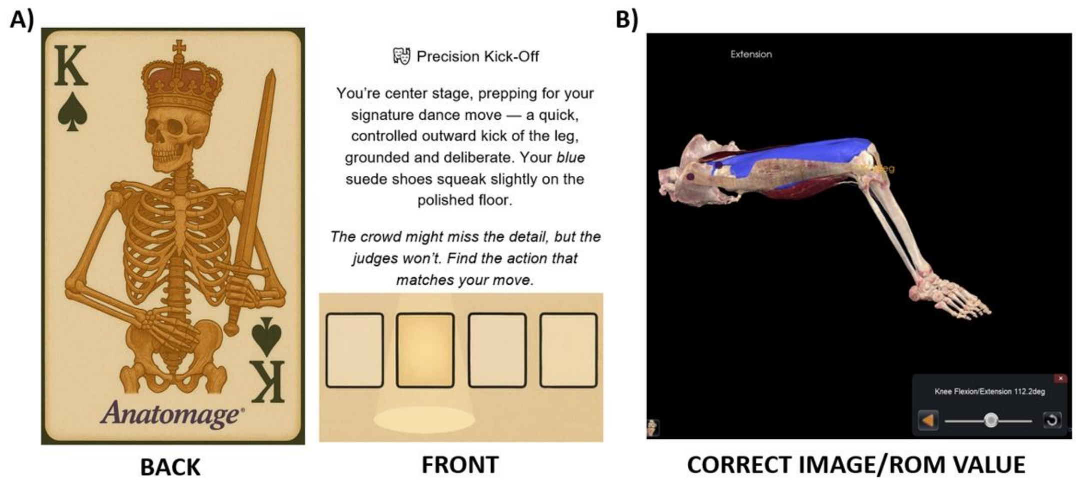


Figure 5: Talent card (A) describing extension, hinting at a concentric motion with blue, and matching Anatomage image (B) highlighting the active muscle and corresponding ROM.

Each team received "talent cards" describing specific movements. They performed these motions within their team to determine the action being described (e.g., extension vs. flexion; concentric vs. eccentric). Then, they searched through numerous Anatomage images posted around the room, some of which showed the opposite action/contraction, to locate one image that matched and recorded the range of motion (ROM) in degrees on the talent card. For prompting, the educator established that blue-highlighted muscles indicate concentric contraction, while red indicates eccentric contraction, consistent with the Anatomage Table's visual cues. ChatGPT generated the talent design and riddle based on this movement/playing card concept, which the educator prompted. Figure 5 illustrates a movement identification task from the *Casino of Motion*. Panel A displays the front and back of a "talent card" containing a riddle that describes a specific action and subtly hints at the correct motion phase by mentioning "blue." This corresponds to the blue-highlighted muscle in Panel B that represents the correct concentric motion and ROM value needed to complete the challenge. The cards were printed and laminated as reusable 5x7 playing cards, allowing teams to write on them with dry-erase marker. This was an idea from the educator to reduce printing costs and enable repeated use, as the escape room was run multiple times in one day and again after the tournament. In addition to the talent description, the front side featured three or four blanks in which students recorded the ROM (Figure 5A). They used the number in the spotlight later for the lock code. Figure 6 shows a final challenge Joker card where embedded hints—such as the use of color-coded words like *royal*, *spotlight*, and *flush*—guided teams to arrange cards in a high-to-low "royal flush" and extract spotlighted ROM values from task sequences to unlock the Motor Chip.

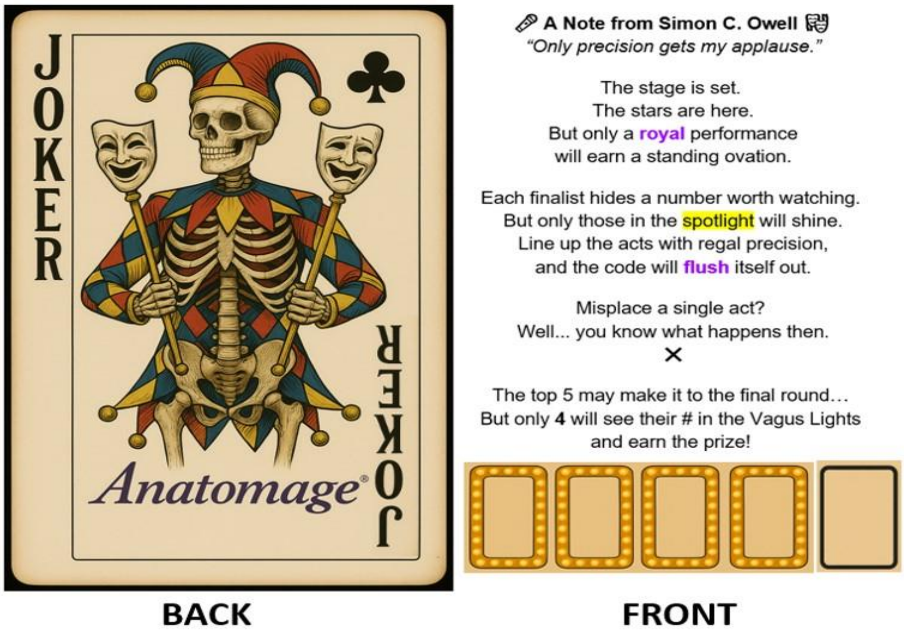


Figure 6: The final "Joker" card provided clues guiding teams to arrange previously collected ROM values in a high-to-low royal flush sequence to unlock the Motor Chip.

5.2.2 Casino of Senses

Figure 7 presents the narrative and mission overview for *Casino Cranialis – The Casino of Senses*. In this casino, teams solved rhyming riddles tied to the cranial nerves to recover the Neural Senses Chip.

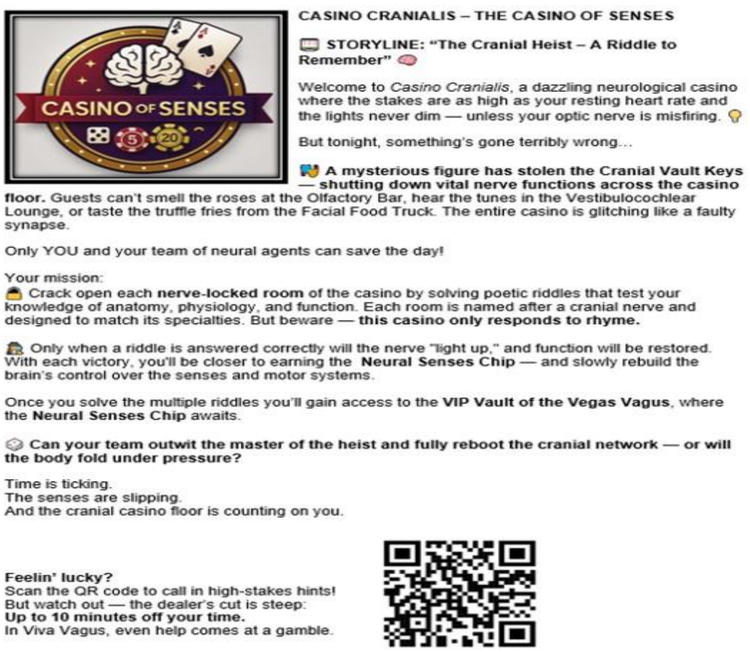


Figure 7: Storyline and challenge instructions for *Casino Cranialis*, a cranial nerve-themed riddle station with optional QR code hints.

An optional QR code was provided to offer time-costing hints from the "The Cranial Nerves Song" YouTube video [31], aiding gameplay if needed. In this video, Perera uses music to help students memorize the functions and order of the cranial nerves. The author used the lyrical transcript from the video [31] to prompt ChatGPT in generating anatomically themed riddles for the escape room activity (Figure 8). Successful decoding of riddles restored the casino's sensory functions and granted the Neural Senses Chip by finding the number 8 key hidden in the room, among others, in a decorative skull (Figure 8). The solutions to riddles were names of cranial nerves; therefore, the author strategically placed Anatomage images depicting individual cranial nerves around the room (Figure 9). These visuals served a dual purpose: first, to support student recall of nerve names, associated functions, and correct spelling; and second, to act as environmental distractors that added complexity to the other casino-themed gameplay.

5.2.3 *House of Homeostasis*

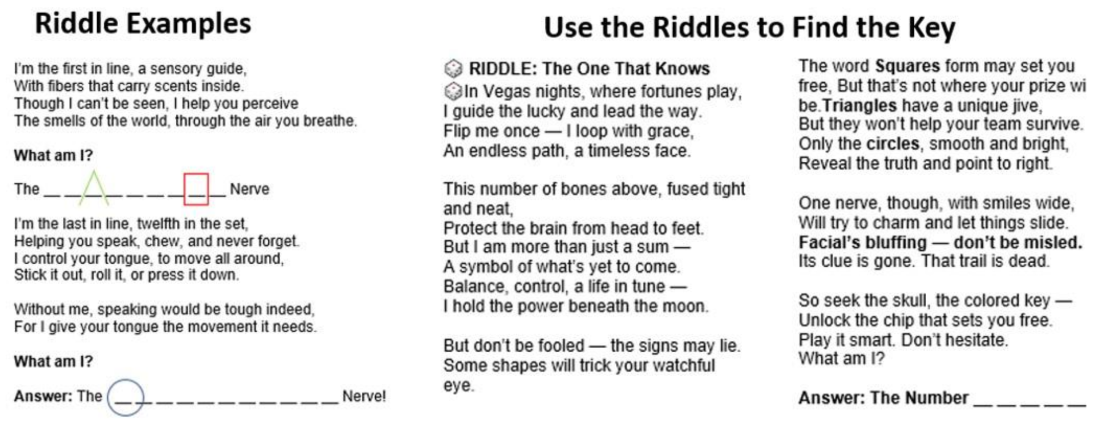


Figure 9: Example cranial nerve riddles and a final challenge riddle that guides teams to identify key anatomical clues and extract a numeric code

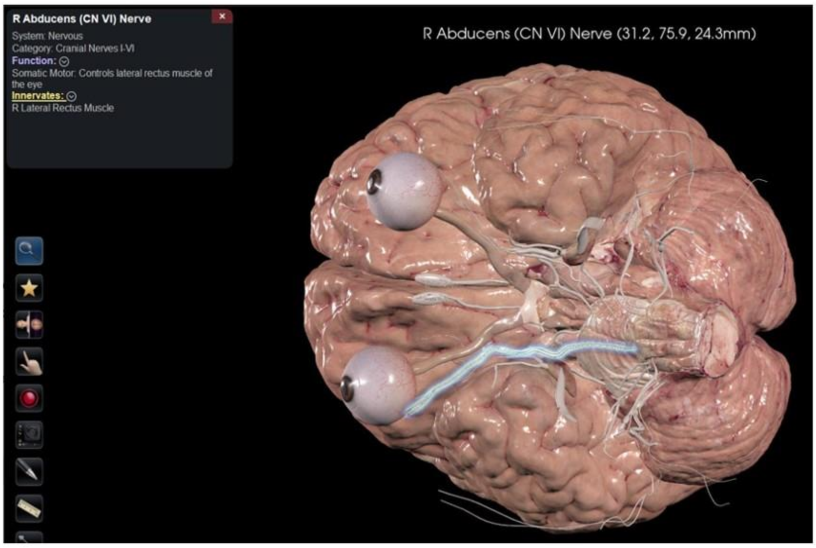


Figure 8: Anatomage image of a cranial nerve, one of several posted around the room to help students recall nerves, their functions, and correct spelling.

The *House of Homeostasis* casino used a metabolic crisis scenario featuring Elvis Presley as a symbolic figure of failed glucose regulation (Figure 10). This was an idea prompted by the educator who recognized that the

Anatomage Table included a diabetes-focused homeostasis function and that Elvis (iconic in Las Vegas) famously struggled with health issues like diabetes.

Teams answered multiple-choice questions about glucose regulation and had the opportunity to watch video clips from the Anatomage Table via QR codes for hints if needed. Correct answers to the multiple-choice diagnostic quiz revealed a pattern of letters in colored boxes. From this, they derived a code. They searched for this code on fake urine samples labeled with ChatGPT-created celebrity pseudonyms located on a *Celebrity Clinic* table in the room. They aimed to identify the correct sample associated with Elvis's celebrity alias (G. Lucose) and locate his corresponding medical chart in the files. The medical chart showed where to find the hidden Glucose Chip by recommending he receive a pancreas and kidney transplant. This hinted that the chip was locked in an "organ transplant" bag nearby (Figure 11). ChatGPT was prompted to generate the riddles and case details based on this bag and the urine sample containers (not pictured), which the educator sourced online to enhance the realism of the activity.

G. Lucose

Vitals: BP 140/92, HR 104, BG 268 mg/dL
History: Type 2 diabetes (20+ years), poor dietary complianc
Concern: Frequent urination, blurry vision, foot pain
Labs:

- Glucose: High
- Urine: Positive for glucose and mild proteinuria
- Creatinine: Elevated
- eGFR: Low

Notes: Evidence of diabetic nephropathy.
****** Recommended for combined kidney-pancreas transplant evaluation.***

Figure 10: Sample patient chart from the *Celebrity Clinic*, where students analyzed lab data and symptoms to identify diabetic complications and medical recommendations to determine where to unlock the Glucose Chip.

STORYLINE: Welcome to the House of Homeostasis — where balance is everything.

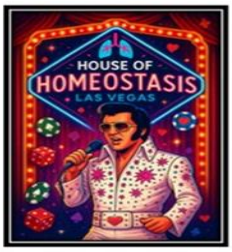
In this glitzy Vegas casino, the body is the ultimate high-stakes game. Inside, every system is a table, every bet is a response, and **The King himself — Elvis Presley — is tonight's headliner.**

But trouble's brewing backstage.

Elvis has been feeling off: fatigue, blurred vision, frequent bathroom breaks. His signature moves are shaky, and the Viva Vagus crowd is getting restless. Word is, **his body's feedback loops are failing** — and if he doesn't regulate soon, the show (and the body) might crash.

Luckily, you and your team have access to:

- **Three short video clips** showing different homeostasis pathways
- **A diagnostic quiz** to help identify what's going wrong



UPDATE FROM MEDICAL:

After his near-collapse, **Elvis was rushed to the back wing of the casino**, known only to insiders as the **Celebrity Clinic** — a high-profile, high-discretion unit for VIP bodily malfunctions.

There, he provided a **urine sample** and was placed under observation.

- Remember, this is a **Celebrity Clinic** so it is full **of mysterious urine samples and corresponding lab charts**, labeled with celebrity-inspired aliases like "A. Pelvis," "Rhett O'Cytes," "G. Lucose," and more…
- *"What Happens in Vagus, stays in Vagus!" is definitely true for Celebrities like these!*

Now it's up to **you** to:

- Use the answers from your **multiple-choice quiz**
- Decode the correct 4-digit lab code
- Match it to the **correct urine sample and patient chart** to lead you to the **Glucose Chip.** Only **one** sample is Elvis's. Only **one** contains the **correct numeric code** that will unlock the next stage of his care!

Figure 11: *House of Homeostasis*, where a metabolic crisis involving Elvis Presley challenges teams to diagnose failed glucose regulation using Anatomage content and a Celebrity Clinic puzzle.

5.2.4 Puzzle Palace

Puzzle Palace Casino transformed anatomy review into a slot-machine-style challenge (Figure 12). In this casino, students sorted Slot Cards into trios based on clues from images and function or structure (e.g., right-sided-only muscles, blood vessels involved in different types of stroke, bones categorized as tarsals, muscles involved in eye movement, etc.).

Figure 13 shows an example of this challenge where students matched three anatomical images representing muscles that insert at the pes anserinus, guided by the poetic clue card titled "The Triple Threat." The educator embedded the anatomical hint "goose-footed finale" to reference the pes anserine, while ChatGPT incorporated the mnemonic "Say Grace before Tea" to cue students toward identifying sartorius, gracilis, and semitendinosus.

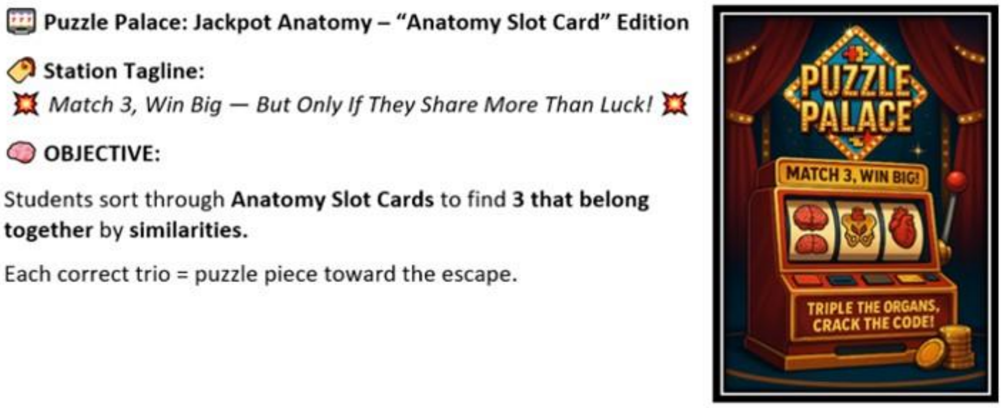


Figure 12: *Puzzle Palace Casino*, where students sort Anatomy Slot Cards to identify matching trios based on anatomical similarities to unlock pieces of the escape code.

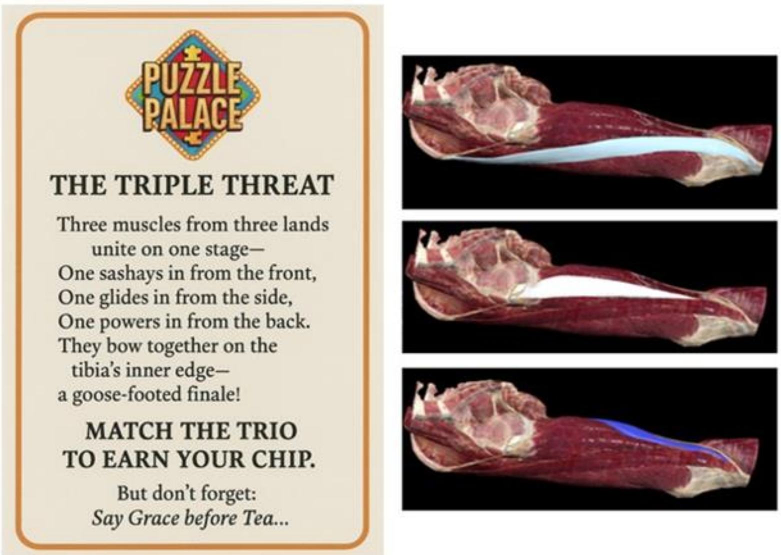
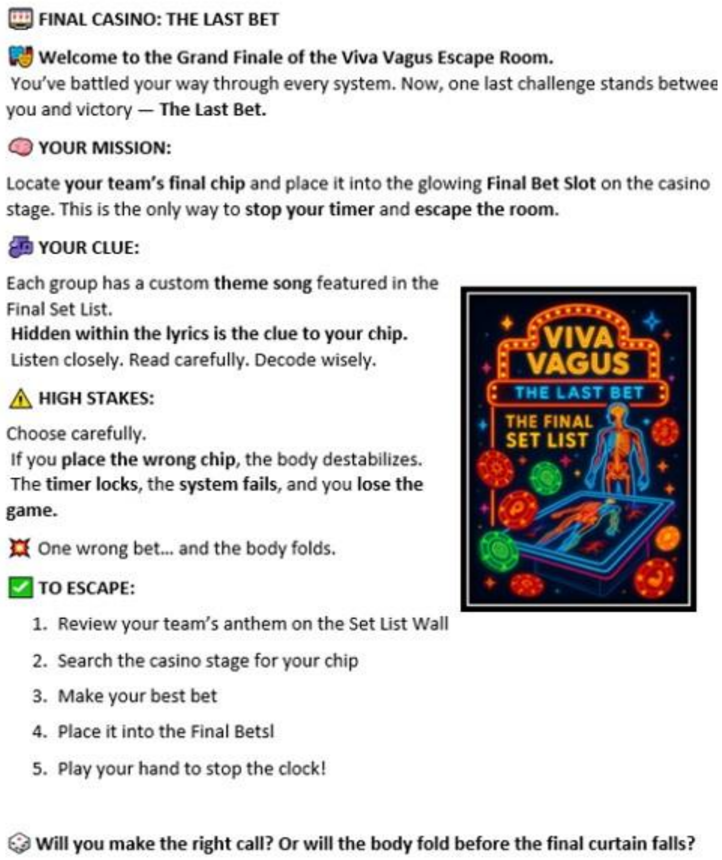


Figure 13: *Puzzle Palace* task where students match the pes anserine muscle trio using image clues and the mnemonic "Say Grace before Tea."

To increase difficulty and encourage interactive problem-solving, the chips were hidden in a variety of creative locations. For this casino, a fake book safe was purchased online ChatGPT was prompted to incorporate it into the scenario's clues.

Figure 14 shows the final *Puzzle Palace* sequence: the poetic clue (A) instructed students to arrange their matched trios into a grid, which revealed the serratus anterior image on the back (B); this anatomical hint then led them to a hidden combination lock inside the fake book safe labeled *Love With Your Whole Heart* (C). The educator intentionally chose the boxing theme, recognizing its cultural relevance in Las Vegas, and incorporated a "3 of a kind" slot machine format to maximize use of Anatomage images across multiple body regions and physiological systems.

5.2.5 Viva Vagus: The Last Bet



FINAL CASINO: THE LAST BET

Welcome to the Grand Finale of the Viva Vagus Escape Room.
You've battled your way through every system. Now, one last challenge stands betwee you and victory — **The Last Bet.**

YOUR MISSION:

Locate **your team's final chip** and place it into the glowing **Final Bet Slot** on the casino stage. This is the only way to **stop your timer** and **escape the room.**

YOUR CLUE:

Each group has a custom **theme song** featured in the Final Set List.
Hidden within the lyrics is the clue to your chip.
Listen closely. Read carefully. Decode wisely.

HIGH STAKES:

Choose carefully.
If you **place the wrong chip**, the body destabilizes.
The **timer locks**, the **system fails**, and you **lose the game.**

One wrong bet... and the body folds.

TO ESCAPE:

1. Review your team's anthem on the Set List Wall
2. Search the casino stage for your chip
3. Make your best bet
4. Place it into the Final Betsl
5. Play your hand to stop the clock!

Will you make the right call? Or will the body fold before the final curtain falls?

Figure 15: Final challenge, *Viva Vagus: The Last Bet*, where students used clues from their team anthem on a Final Set List to place their final bet and stop the timer to escape.

In the final casino, *Viva Vagus: The Last Bet*, students used the four chips earned from previous stations along with a fifth chip to place their final bet in a felt-lined betting area. Before reaching the tournament in Vegas, each team had chosen a unique name for its competing Anatomage Team. Using this, they were subsequently grouped into workshop cohorts with names such as Aorta, Biceps, and Diaphragm, among others. The educator incorporated these identifiers into a creative musical *Final Set List* created by ChatGPT and posted it on the wall. Here, students had to locate their team's anthem, decode the clue, and match it to the correct chip to stop the timer and escape the room (Figure 15). While ChatGPT generated the basic layout and wording for the time card, the educator developed the final gameplay experience, including the use of a felt-lined betting area to conceal chip placement and real poker chips labeled with custom stickers indicating the casino where each was earned. This enhanced the tactile, immersive quality of the escape room's conclusion.

Final Bet Instructions:

- Place your **5 chips** in your team's designated felt area at the **Final Bet Table**.
- Fold the felt over your chips to **conceal your bet** (never show your hand in Vegas!).
- Notify the **Game Master (or staff)** to record your final time.
- If your chips are **correct**, your time stands to win.
- If a chip is **wrong**... the body fails. You lose the round.

Figure 16: Final Bet instructions and game completion time card used to verify each team's escape in the Viva Vagus challenge.

5.3 Phase 3: Implementation and Logistics

The final materials were formatted for printing, laminating, and easy distribution, with each group receiving a box containing a full set of "casinos" in separate envelopes. Volunteers were trained as facilitators to ensure smooth flow and reset between teams, allowing multiple groups to participate simultaneously in the same room.

5.4 Facilitator Observations

Facilitators noted high engagement and collaboration within teams. Students consistently used anatomical terminology, applied clinical reasoning, and adapted strategies in response to misdirections. Observations confirmed that the escape room format promoted critical thinking, teamwork, and integrated learning of body systems. However, facilitators also observed that students often ignored provided instructions and instead jumped directly into problem-solving, which led to confusion in locating subsequent clues and disrupted the intended flow of the game. In these instances, facilitators had to offer hints to redirect students or explicitly point them back to the original instructions in their casino packets to help them reorient and progress effectively through the activity.

Specific limitations observed in the *Casino of Motion* were that many high school students were unfamiliar with the concept of a "royal flush," which led to confusion during the final task. Additionally, the Jack card that ChatGPT created was a different suit from the others, which went unnoticed during game setup and caused uncertainty for teams' understanding of the concept of a “royal flush.” These issues will be clarified and corrected in future iterations of the game to ensure smoother gameplay and clearer expectations.

6. Discussion

The multi-casino format allowed for system-based integration of anatomy and physiology in an interactive environment. The use of ChatGPT significantly reduced the creative burden of designing riddles, puzzles, and thematic structures. This empowered the educator to focus on pedagogy, as ChatGPT served as a collaborative partner, enhancing thematic cohesion and learner immersion [15,16,17]. Each casino reinforced specific anatomical content while engaging students in experiential learning. Prior studies have demonstrated that gamification strategies such as escape rooms can significantly improve engagement and learning outcomes in medical education. Gamified environments, such as escape rooms, have been shown to enhance teamwork and collaborative problem-solving. The use of escape room formats in anatomy education has also been shown to be effective for detailed instruction in regional anatomy, including complex areas such as the head and neck [3-10].

Several challenges emerged during the design and implementation of *Viva Vagus – The Last Bet*. First, the creation of engaging yet educational puzzles required careful alignment between anatomical accuracy and creativity. Puzzle designs had to strike a balance between entertainment and pedagogical rigor. Ensuring clinical accuracy, particularly in cases involving muscle function or cranial nerve interpretation, demanded repeated revisions and anatomical verification. Additionally, incorporating diverse learning modalities — such as movement-based ROM interpretation, poetic riddle-solving, and metabolic video diagnostics — required technical planning. Printing, formatting QR-based hint systems, and managing physical props added complexity to classroom logistics.

Design decisions were made with intention. For example, using the vagus nerve as a narrative thread allowed for the inclusion of multiple body systems in a cohesive storyline. Integrating a “Final Bet” mechanism reinforced synthesis and decision-making. Humor and pop culture references were used strategically to enhance immersion without diluting academic content. While ChatGPT contributed to writing clues and formatting, its ability to sustain layered puzzle-building and thematic continuity required significant input and oversight from the educator. This further highlights the current limitations in the depth of creative development of genAI.

While this escape room set-up offers a polished and immersive experience, it can be costly to produce at full scale. Purchased props significantly enhanced the escape room's environment, creating a visually engaging and thematic experience that drew participants into the storyline. These props added value; however, many could be scaled back or substituted with low-cost alternatives to reduce expenses. Importantly, the majority of props are durable and versatile, allowing for repeated use across future events—even with entirely different escape room themes—making them a cost-effective investment over time. The supplied materials are also easily adjustable. They can be downsized, printed in black and white, reused with lamination, or converted to digital formats, which would also reduce expenses and simplify logistics. One logistics challenge encountered during the event involved the handouts, several of which were designed to be printed in color to support puzzle-solving elements. For example, the *House of Homeostasis* multiple-choice quiz relied on color-coded answers to generate a numerical code, while *Casino Cranialis* required participants to arrange colored boxes in a specific sequence to reveal a hidden word pattern such as "eight." Due to a miscommunication during setup, some handouts were printed in black and white, and certain pages were unintentionally placed out of order. This initially confused students until the issue was identified and corrected.

The escape room was constrained by the tournament's predetermined 45-minute workshop schedule, which limited the amount of time available for instruction, gameplay, and debriefing. As a result, only 30 minutes could be dedicated to the escape room itself, which limited participants' ability to engage with and complete all five casino-themed challenges fully. While the fast-paced environment encouraged engagement and urgency, the limited time often led teams to rush through activities, reducing opportunities for deeper critical thinking, analytical reasoning, and collaborative problem-solving. Several groups expressed frustration at not being able to reach the final challenge or complete the entire storyline. This suggests that extending the timeframe could enhance the educational value and overall satisfaction of the experience.

Evaluation of the activity's effectiveness relied on facilitators' observations and student behavior. Students demonstrated strong engagement, enthusiastic collaboration, and accurate use of anatomical vocabulary throughout the activity. The format encouraged verbal reasoning, visual interpretation, and kinesthetic problem-solving. While no formal learning assessments were conducted, the activity clearly promoted active learning. From an educator's perspective, the escape room offered a unique opportunity to observe students practicing applied anatomy in real-time. Students frequently expressed excitement, made unsolicited clinical connections, and demonstrated effective communication—particularly during interdisciplinary and multi-step stations. These findings collectively support the integration of genAI-assisted design into health science curricula.

Although the escape room was initially developed as an educational workshop rather than a formal research study, the author acknowledges that relying solely on observational data is a limitation. Future research will incorporate both qualitative and quantitative methods—such as pre- and post-tests, participant surveys, and focus group interviews—to more rigorously evaluate the learning outcomes and instructional impact of genAI-supported anatomy experiences.

6. Conclusion

The *Viva Vagus – The Last Bet* educational escape room showcased the powerful intersection of gamification and anatomy curriculum. Designed collaboratively using ChatGPT, the Anatomage Table, and the author's anatomical expertise, the workshop engaged students in applied, scenario-based learning that emphasized clinical reasoning, teamwork, and active problem-solving. Observational data revealed strong student engagement, enthusiastic collaboration, and appropriate use of anatomical language, all of which point to the educational promise of immersive, genAI-assisted design.

However, several limitations warrant attention. The most significant is the lack of formal assessment measures; effectiveness was evaluated solely through facilitators' observation and anecdotal student feedback. No pre- or post-tests, surveys, or structured evaluations were administered, which limited the ability to quantify learning gains or compare outcomes to those of traditional instruction. Additionally, time constraints and logistical challenges (such as session duration and setup requirements) may have affected student performance and experience. The generalizability of the results is also limited, as the activity was conducted in a competitive, high-energy conference setting, rather than a controlled classroom environment.

Future directions include formalizing the escape room activity as a research intervention/activity. This will involve collecting both quantitative and qualitative data, such as pre- and post-intervention knowledge assessments, student reflection responses, satisfaction surveys, and focus group interviews. These methods will enable a deeper understanding of how genAI-enhanced gamification impacts learning, retention, teamwork, and confidence. Additional iterations could explore customization for various health professions, integration into complete course modules, and scalability across disciplines.

Ultimately, this serves as a replicable model for educators seeking to innovate their curriculum. It illustrates how genAI-supported design can extend beyond novelty to serve as a meaningful tool for enhancing student engagement, deepening content mastery, and preparing learners for the complexities of clinical practice.

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7. Conflict of Interest

The author declares that she has no conflict of interest.

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