



Regular Article

Are you ready to play Pathology Pyramid? An exploration of an alternative method of learning through gaming in pathology resident education



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ABSTRACT

The pathologists' lexicon is paramount in connecting pathologists, clinicians, and patients. It is an implicit part of pathology diagnoses, and, therefore, a significant component of residency training. We recognize that learning and honing this art is acquired through experience but is also influenced by many factors, such as confidence, familiarity with descriptive terminology, among others. Our project assessed resident views pertaining to their education and perceptions of their descriptive skills. We then introduced Pathology Pyramid (PathPyramid), an educational initiative in a game-style format, which emphasizes communication and supports the goals of strengthening communication in pathology and building confidence. To play PathPyramid, a resident receives a pathology image and describes findings to their team (who do not see the image). The team answers the given prompts related to the image. Pre-game questionnaire was given to trainees to assess perceptions of their abilities in describing pathologic findings. Post-game questionnaire focused on the game's ability to achieve the goals of the activity. Surveys indicate that PathPyramid's strengths lie in building confidence in describing findings in a group and teambuilding. Additionally, variability of responses among trainee sheds light on unseen aspects of individual learning path diversity irrespective of year in training. PathPyramid complements a pathology residency curriculum by helping to erode potential barriers in communication, while fostering comradery.

Keywords: Pathology, Residents, Education, Medical, Game, Curriculum, Confidence, Histology

Introduction

Pathologic diagnoses are rooted in learning the art of describing and communicating, and the keystone of delivering the most accurate diagnosis is based on the ability to describe an entity. This skill leads to building effective communication in various settings including in conferences and in reports, establishment and promotion of collegiality (among pathologists, other clinicians and learners), and delivery of quality patient care. Honing this ability to interpret and effectively communicate gross and histologic findings is embedded in the educational experiences of training, including traditional one-to-one sign-outs between faculty and trainees, lectures, slide sessions/seminars, or other group activities based around the microscope. This sparks a few questions. What intangible elements exist between pathology education and the overall employment of diagnostic and interpretive skills into successful practice? Learning depends not only on the personal interpretation and internalization of the knowledge or learning opportunity but is a collaborative interaction, and the collective process is subject to influences by both internal and external factors, such as confidence, familiarity with the appropriate terminology/wordbank, personal learning preferences, motivation, among others. How can we enhance pathology

education to address these elements? What are the trainees' perceptions of their communication skills and confidence in descriptive abilities? Our work explores these questions in a pathology training program by focusing on communication and descriptive skills. We use this opportunity to complement the traditional curriculum with educational experiences that help address these intangible elements and further support the development of these skills. In our study, we implemented an alternative educational tool with integration of game theory in pathology education: Pathology Pyramid (PathPyramid).

When employing gaming theory in an educational setting, it is important to consider the characteristics of successful educational games. Educational games may serve to create scenarios simulating real-life situations—offering an opportunity to make decisions, problem solve, test strategies, and acquire knowledge from new perspectives. Similar to gaming for pleasure, these activities should incorporate elements that encourage users to play: incentives, goal-oriented framework, competitiveness, immediate feedback, and rewards.^{1,2} In medical education, aspects that foster the positive attributes needed in the healthcare setting should also be included, such as teamwork, teambuilding, and communication. Several studies in internal medicine, surgery, and family medicine residency programs have seen a positive influence of the

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gamification of curriculum elements,³⁻⁶ including enjoyment and increased trainee satisfaction with the introduction of games to the curriculum, as well as showing promise of knowledge retention and academic success. Multiple medical education settings, in which gaming has been implemented, have been able to excel in building confidence, team performance,^{7,8} and positive reinforcement and collegiality,⁹ regardless of said games' efforts to improve knowledge base or retention. This highlights that gaming in medical education has multiple facets in which it can be deemed successful and beneficial.

Gaming principles, eloquently adapted to a healthcare setting by Awan et al.,⁹ describe a framework on which to build a game in an educational setting: interactivity with informative feedback, meaningful goals, experience of growth, feeling of safety, and engaging the senses. Creating a safe and comfortable environment is an important consideration,¹ as failure and "wrong answers" are possible and should not be avoided because they provide significant learning opportunities. With these tenets in mind, introducing gaming theory can promote these positive objectives while simultaneously offering unique ways to address barriers to education and learning within a group setting. One of the most compelling barriers to education is fear of being embarrassed associated with an unfamiliarity of peers.¹⁰ By creating a safe learning environment that encourages trainees to become acquainted with their colleagues, trainees are able to increase participation and reduce anxiety, which can translate beyond the game and into other areas where healthcare professionals interact.^{11,12} With regards to our project, we recognize the value of gaming theory in education to accomplish multiple goals. Importantly, to the best of our knowledge and review of the literature, specific literature related to gaming theory application specifically in pathology residency education programs is virtually nonexistent.¹³ The introduction of PathPyramid and the description of our pilot study is a significant contribution to the literature in this particular area of medical education.

The purpose of our pilot study was to begin the examination of the effectiveness of alternative forms of learning in pathology resident medical education. We also aimed to explore additional factors that may play a role in the pathology residency education, including resident perceptions of their confidence to describe and communicate pathology, and we sought opportunities for growth in trainee education based on these perceptions. These efforts helped to bring us closer to a better understanding of where trainees are on their learning path (a phrase that we use to describe the collection of an individual's educational experiences, learning preferences, values and goals, strengths, and opportunities for growth) and how to promote individual success. We introduced PathPyramid, an educational initiative in a game-style format, that enhances the time-honored, lecture- and slide session-based curriculum with a teambuilding and confidence-promoting exercise to strengthen the art of communication, and therefore, diagnostic skills.

PathPyramid echoes the important tenets of the aforementioned gaming theory studies by offering immediate feedback, competitiveness, safe learning environment, and an engaging format to accomplish these goals. With this stated, the main objectives of PathPyramid is that learners will be able to reinforce material learned through traditional didactics and slide sessions, appreciate how colleagues describe entities with an emphasis on honing vocabulary, practice communicating pathologic findings in a low-stakes environment, and build comradery with other trainees through teamwork.

Materials and methods

A pre-game questionnaire of thirteen questions (Table 1) was issued to trainees (pathology residents, n = 14) at the Hospital of the University of Pennsylvania before the introduction of PathPyramid to establish a need for this initiative and assess the following: residents own confidence in describing pathologic findings, individual participation in educational sessions, and interest in new learning events. Questions 12 and 13 were

Table 1

Questions asked on the pre-game questionnaire ordered by number.

Question number	Pre-PathPyramid questions
1	I regularly attend slide sessions.
2	At slide sessions, I voluntarily participate in describing histology in the group setting.
3	I am confident in my ability to describe histology.
4	I have the appropriate word bank to accurately describe histology and gross pathology.
5	A better understanding and knowledge of descriptive terms can help my diagnostic ability.
6	The likelihood of "being called on"/selected to describe histology affects my attendance to slide sessions.
7	I am interested in a dedicated session or series to learn description terminology.
8	I am interested in tutorials or educational conferences on how to approach histology descriptions at tumor boards, conferences, and/or to clinicians.
9	I am confident during sign out in describing the histology/pathology to my attending.
10	I am confident in my ability to describe histology/pathology to my peers (co-residents and/or co-fellows).
11	I feel comfortable and confident describing histology/pathology in any group setting.

optional-free response questions and are not shown in Table 1. The responses were anonymized by the creation of unique number in order to link the pre- and post-game questionnaires together if needed. A response scale from 1 to 10 was used (i.e. 1: strongly disagree, 10: strongly agree) with an accompanying comment box for each question. This scale was chosen to allow for assessment of responses on a more granular level. The data was divided into junior (J; PGY-1 and PGY-2; n = 9) and senior (S; PGY-3 and PGY-4; n = 5) trainees.

PathPyramid was conducted over a virtual platform (Verizon's Blue-jeans) with Microsoft's PowerPoint used as the gameboard.

How to play PathPyramid:

- Trainees were organized into two teams.
- One trainee received an image (histology and/or gross) via email and described the findings to their teammates (who at this time do not see the image). In addition to anatomic pathology images, clinical pathology images (ex: microbiology, hematology, hematopathology) are also incorporated into the game.
 - There is a time limit imposed (from description delivery to submission of answers from teammates).
 - Highly descriptive terms are key but also must exclude direct words in the diagnosis.
 - An example of this is as follows: If the diagnosis is "squamous cell carcinoma," the description cannot be given as "malignant squamous cells" but rather given as (if applicable) "nests of cells with ample eosinophilic cytoplasm and enlarged, hyperchromatic nuclei with areas of swirled rings of cells embedded with large eosinophilic pearls."
 - An alternative example includes a gross photo of a myocardial infarction. While this gross finding can be easily identified at inspection and labeled as such, the game encourages articulation of the gross details that leads one to the correct labeling of "infarction" (i.e. "... within the myocardium is a mottled region with a hyperemic border surrounding central yellow-tan area").
- Question prompts appear on screen to guide the description of the image (i.e. "What organ is this?," "What is the diagnosis?," "What is the differential diagnosis for this entity?," "What immunohistochemical stains would you order?").
- The teammates are tasked with answering the questions based on the description provided. Successfully answering the questions heavily relies on the detailed and accurate description provided by the teammate who received the image.

- A correct answer yielded the same team to play again with a different member now describing a new image; an incorrect answer turned the next round over to the other team. Once the time limit was reached or the question prompts were successfully answered, the image along with an explanation of the prompts was revealed and time is allotted to review the case (Fig. 1).
- After six rounds, the winner would proceed to a “lightning round,” which included six additional images featuring more pathognomonic findings to facilitate a more rapid progression through the descriptions and diagnoses (i.e. Reed–Sternberg cells described using words such as “large, binucleated cell,” “prominent nucleoli and thickened nuclear membrane,” “halo appearance,” etc.). The answers to the lightning round were revealed once the correct responses were given or the time allotted expired (Fig. 2). Once the answers were revealed to the audience, time was given to discussing the images and their pathologic findings.
- This process of six rounds with a lightning round was repeated again before the game concluded.

Concurrently, an attending pathologist is present. The role of the attending pathologist is aid in the delivery of the histologic or gross description, to ensure quality of the descriptions given, and to guide audience interpretation of that description. For instance, providing additional prompts, such as “how would you describe the cytoplasm?”, “how would you describe the low power appearance?”, or by summarizing the findings described by the trainee are beneficial elements of the game. It offers not only an additional layer of comradery from the mentor–mentee perspective but adds insights that are helpful to the general approach of pathologic descriptions.

During the study, the game was hosted virtually (April 24th, May 1st, and June 12th of 2020), and all trainees were invited; participation was voluntary. After these sessions, a post-game questionnaire (n = 12) was issued, which included the aforementioned questions from the pre-game questionnaire with ten additional questions (Table 2) pertaining to their perception of the game, usefulness of the game’s ability to succeed in learning, effect of game in reducing anxiety when speaking in front of peers, reinforcement of pathology terminology, overall interest in pursuing educational activities in this format, and recommendations for improvement. Analysis of this data included the mean response for each question (Figs. 3A and 4A) and semantic differentials (Figs. 3B and 4B).

Fig. 5 includes the number of responses per answer choice. Statistical analysis for the data was accomplished with a Mann–Whitney *U* test utilizing the statistical package in Microsoft Excel (XLStat). The Mann–Whitney *U* test is an alternative to the unpaired *t*-test to analyze non-parametric data (i.e. it does not assume that the data is normally distributed).¹⁴

Additional PathPyramid sessions continued on various occasions throughout the year following the initial study period. An additional follow-up survey (n = 12) was conducted in August of 2021 (approximately 14 months after the conclusion of the final game) using the aforementioned 1–10 response scale with questions pertaining the long term utility of PathPyramid: interest in introducing PathPyramid into the formal curriculum, retention of material highlight during PathPyramid, confidence at presenting, and comradery (Table 3). Analysis of this data included the mean response and boxplot diagram for each question (Fig. 6).

Results

From the pre-game questionnaire (Table 1; Fig. 3A), question 1 (Q1) indicates that most respondents (n = 14) seem to regularly attend slide sessions with a mean of 7.6 (J = 7.8; S = 6.5). Both junior and senior residents rate their confidence to describe histology (Q3; J = 6.6; S = 7.5) with the appropriate word bank (Q4; J = 6.6; S = 7.8) highly. Questions (Q5, 7, 8) are related to descriptive terms, recognizing the importance of improving one’s lexicon, and interest in tutorials on describing or presenting in various venues. These question responses have an overall high mean response. Additional questions of interest involve voluntary participation to describe findings in slide sessions (Q2) and the likelihood of being “called on” (i.e. selected from the audience to answer a question) affecting attendance (Q6). Q2 overall mean was 5.6 (J = 5.8, S = 4.3), and Q6 overall mean was 4.9 (J = 4.3, S = 7.3). While the means are approximately neutral, the variability among the responses for these questions is high, as seen by the wide range in responses. Juniors and seniors rate their abilities to describe histology to peers and attending pathologists highly (Q9, 10), but there is wide variation among junior and senior groups to do so in a group setting (Q11, range: 1–10). The survey comments do positively endorse current slide sessions as valuable tools for learning and comradery; however, participants indicated interest in additional educational sessions (Q7 = 8.2; Q8 = 7.9) dedicated

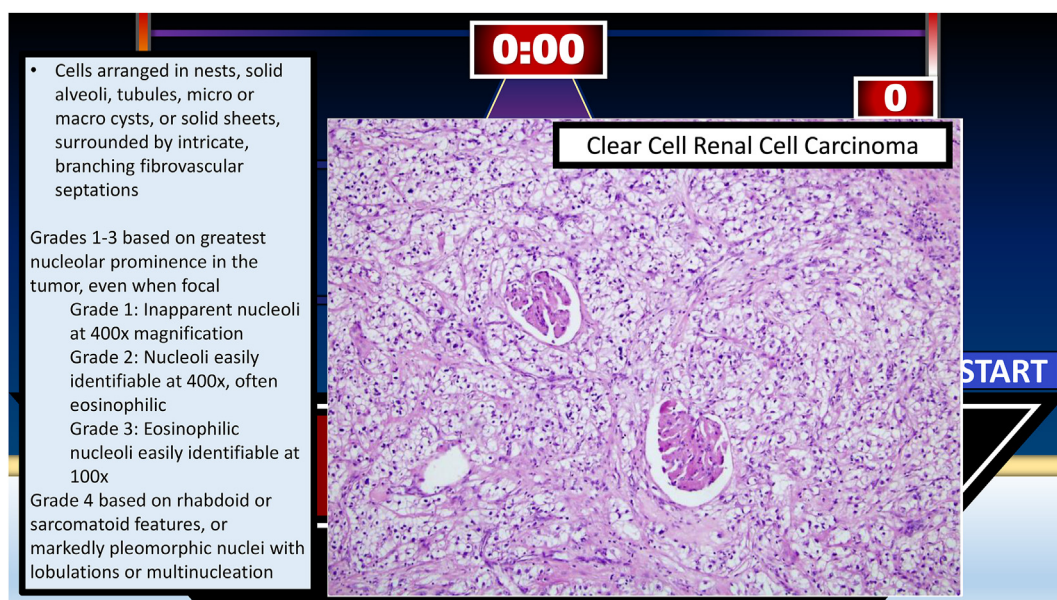


Fig. 1. Screenshot of the game board after a round of PathPyramid with image that was described and brief explanation is revealed to and discussed with the participants.

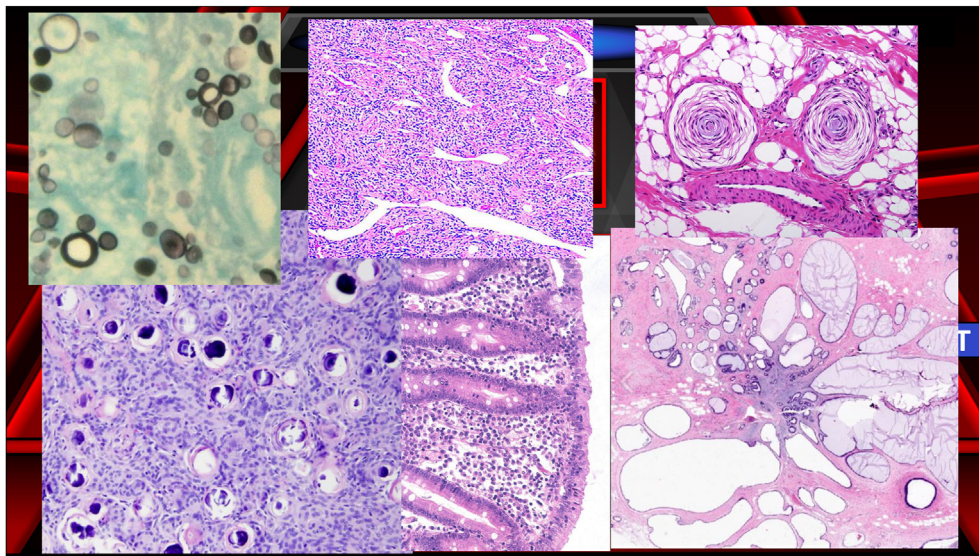


Fig. 2. Screenshot of the game board after a lightning round of PathPyramid with the six images that were described are revealed to the participants for discussion.

Table 2
Questions asked on the post-game questionnaire ordered by number.

Question number	Post-PathPyramid questions
1	I enjoyed (on an entertainment level) the exercise Pathology Pyramid presented on April 24th, May 1st, and June 12th.
2	The exercise helped me reinforce diagnoses that I was already familiar.
3	I found the follow-up questions regarding the diagnosis helpful.
4	During the exercise, I heard/learned new terms to add to my word bank to describe histology and gross pathology.
5	Education formatted in this style (e.g. game) helps my diagnostic ability.
6	The format of the game reduced my anxiety regarding speaking in a group.
7	The exercise fostered comradery between me and my co-residents.
8	I saw entities that I don't know much about during the exercise.
9	The exercise helped me become more confident in describing histology.
10	Please select your top 2 or 3 areas that you found the exercise to have the most impact (multiple choice): Descriptive terminology; confidence in presentation, reviewing diagnoses, describing unfamiliar entities, teambuilding, other ...

to descriptive terminology and approach to presenting pathology in other group settings, such as at tumor boards and conferences.

The semantic differential plots complement the boxplot figures and are an illustrative tool used to visually highlight the variability of responses for an individual and in comparison to other respondents. A series of connected points as a horizontal track represents the responses

of one individual. Within junior and senior groups, questions show wide ranges of responses as demonstrated by the semantic differential (Fig. 3B). For all questions, there were no significant differences between juniors and seniors by Mann–Whitney tests. The p-values for Q1 through Q11 compared between the junior and senior trainees range from 0.094 up to 0.913.

From the post-game questionnaire (Table 2; Fig. 4A), some of the trends in the PathPyramid feedback (n = 16) were as follows (means included in parentheses): PathPyramid was entertaining (Q1 = 8.9), the secondary questions included in the game were helpful (Q3 = 9.1), the format was impactful to trainees’ diagnostic ability (Q5 = 8.6), and PathPyramid fostered comradery (Q7 = 9.1) especially during the COVID-19 pandemic. Furthermore, PathPyramid helped to reinforce familiar diagnoses (Q2 = 8.3) and build confidence in describing histology (Q9 = 7.4). Mean responses on how the game addressed new descriptive terminology (Q4 = 6.1) and new pathologic entities (Q8 = 5.6) were closer to a neutral rating. Comments indicated that the game format was enjoyed by most of the trainees. Teambuilding and descriptive terminology were the most valued aspects. Additionally, trainees perceived PathPyramid as a less stressful form of being in the “hotseat,” a metaphorical position in which a person takes full responsibility for a situation, including being answerable to questions and decisions (Q10; Fig. 5).

The follow-up survey (n = 12) revealed that there is high interest among trainees to incorporate PathPyramid into the curriculum (Fig. 6; Q1 = 8.6). While majority of the residents tend to favor this proposal, we do recognize and appreciate the variability in responses (seen in Fig. 6, Q1), which reflects in part learning preferences. Furthermore, more than

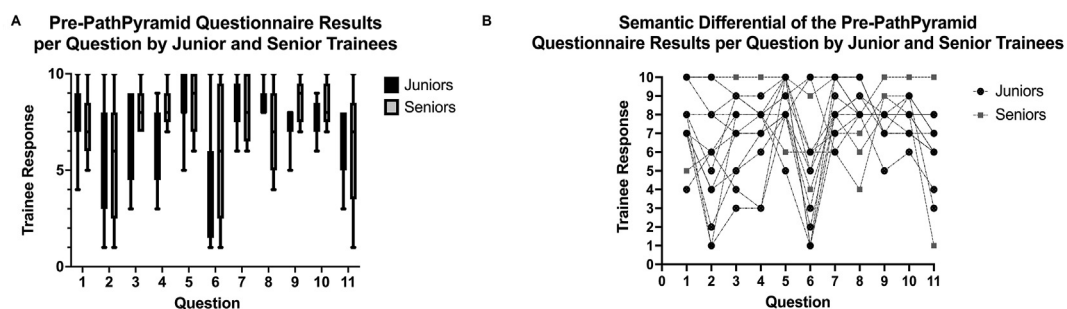


Fig. 3. (A) Boxplots and (B) semantic differential demonstrating junior and senior trainee responses to the pre-game questionnaire (see Table 1 for full list of questions).

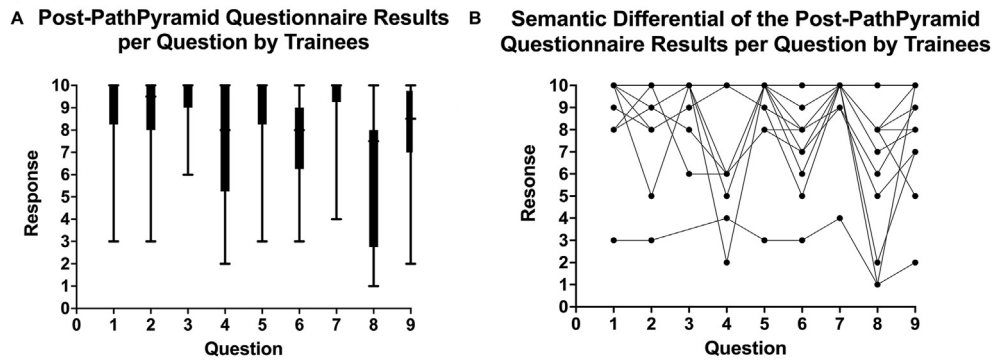


Fig. 4. (A) Boxplots and (B) semantic differential demonstrating trainee responses to the post-game questionnaire (see Table 2 for full list of questions).

Post-PathPyramid Questionnaire Question 10 Responses

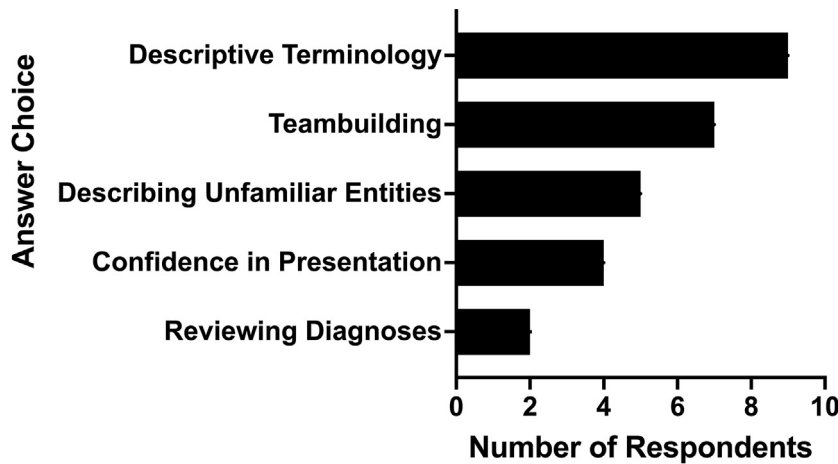


Fig. 5. Trainee responses to question 10 from the post-game questionnaire (see Table 2 for full list of questions).

Table 3
Questions asked on the follow-up questionnaire ordered by number.

Question number	Follow-up PathPyramid questions
1	I would like to see Pathology Pyramid integrated into our regularly schedule AP/CP didactic teaching schedule.
2	Since the introduction of Pathology Pyramid, I have had specific instances in my residency where I have remembered something about a case (description, IHC, disease characteristics, etc.) that was covered during the game.
3	Pathology Pyramid aids in my confidence to describe histology in group settings (conferences, tumor boards, presentations, etc.).
4	Pathology Pyramid is able to foster teambuilding and comradery among my peers.

a year after the last PathPyramid event, trainees indicated that there were specific instances where they had recalled material covered from the session (Q2 = 6.5), as well as endorsed the ability of PathPyramid to boost confidence (Q3 = 9.2) and teambuilding (Q4 = 9.4).

Discussion

One of the most interesting observations of our PathPyramid initiative and introductory study is the wide variation in responses

(Figs. 3 and 4) regarding learning experiences and preferences among the residents, which appears irrespective of PGY status. This wide variability in responses helps to emphasize that there is inherent value in understanding an individual's learning path, including educational experiences and learning preferences, values and goals, and strengths and opportunities for growth. When discussing medical education, the concept of learning styles frequently emerges, a topic which is not a specific aim of our study's investigation. Our survey data showed that there was no significant statistical difference between junior and senior residents in regards to the various questions assessing confidence in descriptive skills, terminology, and voluntary participation, etc. This helps to underscore that progression, learning, and skill acquisition throughout residency does not follow a predictable, linear manner over the course of training. We can appreciate that the striking diversity in learning paths is a call to incorporate alternative methods of learning in the traditional curriculum.

Residents also expressed that they desire their medical education to reflect this diversity. Offering activities, such as PathPyramid, help to exercise various skills that in turn address the intangible elements that accumulate to produce a self-assured and skilled pathologist, elements which may not be overtly addressed in traditional curricula. With our work and initiatives in this arena of pathology education, we are just beginning to scratch the surface of the what can be done to further understand and support individual learning paths in this field.

Follow-Up PathPyramid Questionnaire

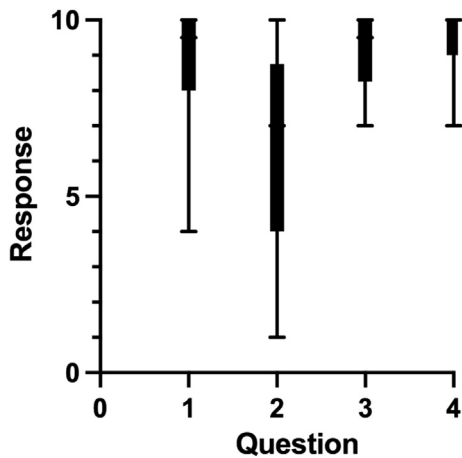


Fig. 6. Boxplots demonstrating trainee responses to follow-up questionnaire (see Table 3 for full list of questions).

Interestingly, while mean responses were closer to the neutral score regarding PathPyramid's ability to address learning new terminology and introduce new pathologic entities, residents simultaneously indicated that the game's strengths lie in reinforcing familiar diagnoses, bolstering diagnostic abilities, and building confidence in describing histology in an enjoyable, safe format. This underscores that knowing the words within a pathologist's lexicon is not entirely sufficient to provide a correct and accurate diagnosis, and having a rich understanding of the descriptive terms is key.¹⁵ PathPyramid may in the future lend itself well to be used as both a learning enhancement practice and an alternative assessment tool offered in a comfortable environment. This environment is created by a group of peers motivated by many factors, including comradery and a collegial competitive quality, along with the support of an attending pathologist to guide players with helpful questions to extract pertinent information and refine a description. By creating scenarios in which a successful outcome (i.e. leading teammates to the correct answer) depends solely upon the use of the pathologist's lexicon, PathPyramid emphasizes the importance and challenges of communication in pathology and the need to emphasize this in the curriculum through activities that engage multiple modalities of information acquisition, such as both visual and auditory senses. A study by Cope et al.¹⁶ also highlights the importance of the dialogue created around describing findings, as the "co-construction" of findings between trainee and trainer was examined. It is not just about "knowing the answer" that is important; it is the ability to articulate and communicate findings, which allows for accurate interpretation and generation of learning. Building confidence in articulating and describing findings, including being able to open the dialogue, is fluid and ongoing and is an important element to promote in residency training.

Anxiety associated with public speaking can be a challenge in medical education as it affects various people in the population, which may include medical students and residents.¹⁶ Therefore, voluntary participation in group settings, presenting cases in a group, as well as being in the "hotseat," can be polarizing issues among trainees and may serve as roadblocks to trainee education. PathPyramid offers a comfortable space to instill confidence and help erode those potential barriers through practice in an open environment and low-stakes discussion of the findings in question. Furthermore, the role of a familiar attending to guide and influence the descriptions and interpretations given by the describer and teammates, respectively, create a stress-free safe zone where the pedagogue serves as the "guide on the side" rather than a superior.

Using the various suggestions and experiences from prior sessions, we continue to recognize opportunities for improvement and gain

inspiration to make effective changes in PathPyramid and facilitate a better educational experience. In the era of the COVID-19 pandemic and social distancing, we adapted our activity to a virtual format. The virtual format has overall been successful, but the initial adaptation to this format presented the need for game modifications. For instance, sending and receiving images via emails and sharing screens for the audience view initially decreased the amount of time allotted for game content and reviewing the answers. One of the ways that we were able to streamline this process is by creating email drafts with the attached images in advance. Additionally, to keep the activity within the allotted hour, we have reduced the number of rounds and images, allowing more time for discussion and review of the questions and images. While our study hosted three events, we continue to play PathPyramid in our residency program. In our current sessions, all of the trainees play as one team, a modification, which is equally enjoyable and maintains the collegial competitive atmosphere as residents strive to earn points for the collective team. While the rapid adaptation to a virtual format was challenging at first, one of the most notable benefits of the virtual format was the excellent opportunity to invite and include residents from affiliated and neighboring hospitals. In addition to continuing sessions in a virtual format, we also have hopes to incorporate in-person traditional slide-based sessions in the future. One of the major strengths of PathPyramid is teambuilding and comradery, which cannot be overstated. A study using a team-based game model in which medical students described a series of pictures to other students who could not see those images in an attempt to place them in a sequential order, endorsed that the most valued benefit of the activity was teambuilding through descriptions and communication, a skill of utmost importance in the medical profession.⁸

As interactive and engaging approaches to education have been shown to enhance learning by further promoting application and analysis of content,^{17,18} we hope to expand PathPyramid's scope to become an integrated component of the core curriculum at our institution. A plan for consistent incorporation includes its use as a review and reinforcing tool employed at the end of organ or topic-specific educational block (i.e. gastrointestinal pathology, breast pathology, neuropathology, etc.) to encourage trainees to revisit the material covered through didactics and from prior clinical cases reviewed. It is also possible to utilize PathPyramid in an assessment capacity, and establish criteria to score the quality and accuracy of the description, the organization and development of the description, identifying and articulating the key features, formulation of a differential diagnosis, among others. We aim to create longitudinal exposure, which has been shown in other studies to be helpful and maintain engagement in the curriculum.^{2,7,9}

We recognize that there are limitations to our study. The limitations of this study include the sample size, taken from one, large urban medical center with local affiliates with a large pathology residency program (but of which may be small compared with other medical specialties). While our sample size is comparable to similar proof-of-concept studies,^{4,16} others manage to include multiple medical campuses in larger specialties.⁶ To fully elucidate the role of this type of learning, extension to other programs and specialties would be informative. Overall, medical education has been slow to adopt gaming and gamification over other markets,⁹ and what has been accomplished in one subspecialty may be difficult to readily generalize to other specialties.¹⁹ However, we can learn from the initiatives taken in all subspecialties to improve medical education in each field with innovative learning tools, such as game-based learning activities. While there is limited research and exploration in this field, a foundation is beginning to form on which to build larger, more comprehensive studies (such as Van Gaalen et al.'s¹³ systematic literature review on gamification in health professional education) to determine the precise outcomes and, thereby, improve learning, which helps to consolidate some of the literature in this area. Of note, the game theory reference in the pathology subspecialty cited in the aforementioned review article was specifically involving undergraduate pathology education, not in pathology residency.²⁰

As indicated by the follow up questionnaire, trainees valued their experiences during PathPyramid, even a year after the last session. Furthermore, over the last year, more trainees than not, recalled an instance when elements discussed at PathPyramid were encountered in their clinical work. As previously mentioned, the impact of PathPyramid on trainee education can be further investigated when implemented into the curriculum to determine areas where it succeeds and meets trainee educational expectations. Our game focuses on “using our words” in a group setting and honing this art of communication that connects us to community and patients. We are excited to continue incorporating PathPyramid into the pathology residency curriculum and exploring ways to understand and embrace learning path diversity with alternative methods of learning.

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Declaration of competing interest

The authors declared no conflicts of interests for this study.

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