

Virtual Patients from the Learner's Perspective: A Convergent Parallel Mixed Method Study Utilizing Evaluation of Technology-enhanced Learning Materials

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ABSTRACT

Background and Objectives. The use of virtual patient simulations in medical education has recently gained significant attention due to the limitations of traditional clinical training methods, particularly during the COVID-19 pandemic. Virtual patients are interactive digital simulations of real-life clinical cases designed to enhance medical education and training. These simulations expose learners to simulated clinical experiences, providing mechanisms for information gathering and clinical decision-making in a safe environment. Although there are studies that state the effect of this technology on learners' performance, there are limited studies that describe how it is perceived by medical students in the local setting.

This study integrated the use of virtual patient simulations in different courses and activities in blended and face-to-face learning to identify the perceptions of medical students in using virtual patients (ViP).

Methods. A convergent parallel mixed method was employed to compare and analyze quantitative and qualitative data. Quantitative data from the database of feedback responses of medical students who had experience with ViP using the evaluation of technology-enhanced learning materials (ETELM), in a private medical school affiliated with a private tertiary hospital in the urban center of a lower-middle-income country. Responses from the 7-point Likert scale of the ETELM questionnaire were quantitatively analyzed. Data from the open-ended questions of the ETELM underwent thematic analysis to find commonalities and patterns among perceptions and comments of the learners.

Results. There were 511 responses analyzed from 280 unique respondents to gain insight into students' perceptions of using ViP. Thematic analysis revealed five themes: objectives, technology, learning activities, performance evaluation, and impact.

Items on the theme of Objectives and Impact had the highest agreement (mean score of 6.02). The Objectives theme revealed that medical students see the importance of session preparation and planning in relation to the content of the virtual patients and their relevance to participants' competency needs. In the Impact theme, ViP gave the respondents the impression of having a realistic experience in patient management; therefore, illustrating their perceived effectiveness of the learning process obtained from the ViP learning sessions. Items on the theme of Performance Evaluation had the lowest agreement (mean score of 5.86). Participants discerned that providing feedback may be helpful to improve their understanding and learning about the material.



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Conclusion. The medical students' perceptions of virtual patients are highly positive. The feedback indicates that the participants felt supported, engaged, and technically prepared. This suggests that the use of ViP aligned effectively with their needs and expectations. However, some improvements in the delivery, feedback, and technical aspects are needed.

Keywords: *virtual patients, learners' perspective, medical education, technology-enhanced learning, simulation*

INTRODUCTION

Traditional medical education in the Philippines often consists of lectures, small group discussions, bedside rounds, and clinical rotations.¹ This established structure forms the backbone of medical education to promote learning and enhance students' clinical reasoning and critical thinking skills while developing their soft skills. Medical education has evolved from traditional classroom learning to the use of digital tools to effectively disseminate information across a new generation of 21st-century learners.² This practice led to paradigm shifts and required significant adaptation of more advanced medical education tools. These tools were essential in sustaining instruction when face-to-face learning was restricted, supporting efficient, flexible, and adaptable approaches to teaching in the midst of the COVID-19 pandemic.³

Even in the post-pandemic era, the Philippines has continued to adopt digital medical education tools, with the emergency shift to online instruction evolving into a blended learning model that integrates digital platforms with face-to-face teaching. Within this model, supplementary tools that foster a clinical-based simulation environment, such as virtual patients (ViP), play a valuable role in strengthening students' critical thinking and clinical reasoning skills. This pedagogical approach complements the learning of medical undergraduates but does not replace the overall effectiveness of face-to-face experiential training.⁴

Currently, the use of virtual simulation employing ViP has a unique role in medical education. ViP, as defined, are real-life clinical scenarios that can be managed by using a computer. The role of the end users is similar to that of healthcare providers, wherein they can obtain clinical history, do physical examination, and make diagnostic and therapeutic decisions to treat the ViP.⁴⁻⁶ In the global context, several studies mention the use of virtual patient simulators in medical education to supplement learning among medical students.^{4,7} There has been evidence that this educational tool can enhance clinical reasoning.^{7,8} A study describes that ViP simulations are an easy-to-use and engaging tool for stress-free learning, particularly at the start of a medical career. It allowed them to develop rational and structured methods, make mistakes without repercussions, and examine and reassess existing knowledge.⁹

In Singapore, it is noted that ViP helps students remember the content and boost their confidence and competence in history taking.¹⁰

A comprehensive evaluation of ViP simulation involves both quantitative and qualitative approaches. These mixed methods provide a deeper understanding of learners' experiences and perceptions of virtual patients.

In medical education, limited interaction with actual and standardized patients can be seen in the learning journey of medical students. Learning gaps are especially seen at the start of the learning journey of medical students. Although standardized patients and actual patients are beneficial for their learning, ViP can supplement the gaps, such as the need for a safe clinical decision-making environment for interventions. Although there are studies that state the effect of this technology on learners' performance, there are limited studies that describe how it is perceived by medical students in the local settings.

The ViP platform was first introduced in the institution during the COVID-19 pandemic, when face-to-face clinical rotations were suspended, and continuity of medical education had to be maintained. The platform served as a repository of virtual cases that replaced real patient encounters and provided access to common medical conditions that students could not observe in hospitals, as most admitted cases at that time were COVID-related. Preparation for its implementation began with the training of the platform administrator, who became responsible for managing and facilitating its use. Departmental teams were then organized, each composed of faculty representatives who acted as champions for integrating the ViP platform into their respective subjects. These teams participated in case selection to ensure that the chosen clinical scenarios aligned with course objectives and enhanced clinical reasoning among students. Separate training sessions for faculty and students followed, focusing on navigation, case management, and the use of the platform's interactive features. The administrative team continued to oversee each ViP activity and provided technical support throughout the sessions. Over time, the ViP platform became part of various instructional approaches, including lectures, flipped classrooms, and Simintegration sessions, demonstrating its adaptability as a technology-enhanced learning tool. The consistent use of the platform across different teaching innovations and strategies established a foundation for aligning learning objectives with instructional design.

This study seeks to identify the perceptions of medical students toward the use of ViP as an educational technology platform and, through the ETELM-LP framework, determine the strengths and weaknesses of the ViP simulation based on the SAMR model, examine students' perceptions of the incorporation of ViP Systems, and explain how they perceive its use in shaping their learning processes as it is integrated into the college's medical curriculum.

METHODS

The study was approved by the institution's ethics review board under ERB approval SL-22219 version 3, dated 25 April 2023.

Study Design, Setting, and Duration

We used the ETELM framework, a convergent parallel mixed-methods design, to assess students' perceptions and analyze both quantitative and qualitative data.

The study was conducted in a private medical school affiliated with a private tertiary hospital in the urban center of a lower-middle-income country, the Philippines, during the academic year 2023-2024.

Study Participants

The research involved the entire population of medical students who experienced using and learning through ViP (Figure 1) and who provided feedback using the Evaluation of Technology-Enhanced Learning Materials (ETELM) framework. Exclusion criteria include students who did not have prior experience using the platform. Incomplete responses, including entries marked as none and N/A, were excluded from the analysis.

Assessment Tool

ETELM is a validated instrument designed to assess the pedagogical and technological elements of a learning activity. It includes the instructor perceptions (ETELM-IP) and learner perceptions (ETELM-LP) regarding the integration of technology into medical education.¹¹ The ETELM-LP survey consists of 29 items. The first 26 items are rated using a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7), while the remaining three items are open-ended questions designed to elicit qualitative feedback.

The instrument also gathers insights that can guide course improvements in future sessions.

Data Collection and Processing

Quantitative Data. The data were culled and reviewed from the institution's database of ETELM-LP Survey Responses from medical students. Responses that were specifically intended to evaluate ViP were included in the dataset utilized for this study. All student feedback that satisfied the inclusion criteria was part of the study. The data were processed using Google Sheets, an online collaborative electronic spreadsheet capable of tabulating data and outputting basic descriptive statistics.

Qualitative Data. The deidentified qualitative data from the open-ended items were thematically analyzed by the researchers following Braun and Clarke's six-phase framework. Keywords were identified, organized into subthemes, and consolidated into themes that represented recurring ideas based on students' written feedback about their experience with the ViP platform.

Researchers 1 and 2 independently developed their own preliminary themes and subthemes, which served as reference points for their respective thematic analyses and interpretations. A joint discussion was subsequently conducted to identify patterns among the responses and align them into common themes and subthemes. Using the agreed-upon framework, the two researchers reviewed and interpreted 280 student responses. Any discrepancies were resolved by Researcher 3, who reviewed the data and reconciled differences to finalize the interpretation. A comprehensive thematic analysis was then conducted collaboratively by all three researchers. These steps were conducted to avoid observer bias.

RDM was the head of the Center for Innovations and was ultimately responsible for all the platforms and for monitoring their performance, both from the learners'



Figure 1. Virtual Patients (ViP) Software.

Table 1. ETELM-LP Quantitative Responses

Questions	Mean (N = 280)
1. <i>Instructions provided a good introduction to the course (e.g., how to get started, where to find various course components, how to obtain technical support if needed, etc.).</i>	6.07
2. <i>Course objectives, expectations, and policies were clearly stated.</i>	5.95
3. <i>The course was well organized.</i>	5.85
4. <i>Course objectives were relevant to my needs.</i>	6.20
5. <i>Navigation of the technology-based components of the course was logical, consistent, and efficient.</i>	5.73
6. <i>The course technologies and media supported the learning objectives.</i>	5.96
7. <i>The computer skills required of participants are appropriate to my technical knowledge.</i>	6.10
8. <i>I had no significant computer / technical problems during this course.</i>	5.29
9. <i>The educational activities encouraged engagement with course materials / content.</i>	6.15
10. <i>The educational activities promoted achievement of the course objectives.</i>	6.10
11. <i>There was a strong instructor presence / personal touch in the course.</i>	6.05
12. <i>Educational activities encouraged interaction and collaboration with other participants.</i>	5.73
13. <i>Requirements for interaction and collaboration with other participants were clearly articulated.</i>	5.75

perspective and the instructors' perspective. LBR is the educational technologist who is responsible for gathering all ETELM-LP surveys regularly. AAL is the educationalist in charge of the Virtual Patients. While all three are interested in the performance of the software being evaluated, none of them has control over the data that is submitted online as part of the quality assurance surveys. LBR and AAL performed the initial thematic analysis, and RDM served to decide on any discrepancies.

RESULTS

The item *"I did not encounter culture- or language-related problems"* garnered the highest agreement (mean of 6.41). This is followed by item 4 with a mean of 6.20, which states that the *"course objectives were relevant to their needs"*. (Table 1)

The lowest agreement was for the item *"they had no significant computer / technical problems"* during this course (mean score, 5.29). This was followed by the statement, *"I received adequate feedback on my learning progress,"* with a mean of 5.36. (Table 1)

There were five main themes: Objectives, Technology, Learning Activities, Performance Evaluation, and Impact (Table 2). These were categorized as "To Improve," "Engage-

Questions	Mean (N = 280)
14. <i>The course effectively blended online and face-to-face elements.</i>	6.00
15. <i>Face-to-face activities contributed meaningfully toward achieving the course learning objectives.</i>	6.02
16. <i>Assessments (e.g., tests and self-assessments) were appropriate for the course objectives, content, and activities.</i>	5.87
17. <i>I had sufficient opportunity to assess and reflect upon my learning progress.</i>	5.68
18. <i>I received adequate feedback on my learning progress.</i>	5.36
19. <i>I had sufficient opportunity to evaluate / provide feedback on the course.</i>	5.86
20. <i>I received adequate support for any technical issues encountered during this course.</i>	6.14
21. <i>I received adequate support for any questions or concerns I had about my learning.</i>	6.05
22. <i>I did not encounter culture- or language-related problems.</i>	6.41
23. <i>I invested enough time and energy to meet / exceed the course expectations.</i>	6.04
24. <i>This course will change my practice.</i>	5.93
25. <i>The overall quality of this course was excellent.</i>	5.86
26. <i>The overall effectiveness of the instructor was excellent.</i>	6.16

ment," and "Experience" to complement the open-ended questions in the ETELM-LP questionnaire, which are:

27. *How could the quality of the course be improved? What would you keep the same? What would you change, remove, or add? Please describe and explain.*
28. *Overall, what elements of this course most contributed to your excitement and engagement as a learner? What could have been done to improve your engagement? Please describe and explain.*
29. *Is there anything else you'd like to share about your experience in this course? If so, please describe and explain.*

Table 2. Five Themes identified through ETELM Open-Ended Questions

Themes	To improve	Engagement	Experience
Learning activities	79 (41.80%)	47 (22.38%)	29 (26.13%)
Performance Evaluation	50 (26.46%)	27 (12.86%)	17 (15.32%)
Technology	35 (18.52%)	42 (20.00%)	42 (37.84%)
Objectives	21 (11.11%)	50 (23.81%)	19 (17.12%)
Impact	4 (2.12%)	44 (20.95%)	4 (3.60%)
Total	189 (100%)	210 (100%)	111 (100%)

Among the five themes, Learning Activities and Performance Evaluation both need improvement at 41.80% (n = 79) and 26.46% (n = 50), respectively (Table 2).

This illustrates that the Objectives of each classroom activity harbored a high student engagement at 23.81% (n = 50), which is also seen in the Learning Activities and Impact at 22.38% (n = 47) and 20.95% (n = 44).

The majority of the student feedback relates to their experience of the use of Technology at 37.84% (n = 42), followed by Learning Activities at 26.13% (n = 29).

The five themes are grouped corresponding to the nine domains of the ETELM-LP questionnaire (Table 3). Means are obtained to determine the overall performance and ranking of the themes.

Table 3. Aggregate Mean of Means from ETELM-LP Questionnaire, Organized by Themes

Themes	Domains	Questionnaire Items number	Mean of means
Objectives	Course Overview, Introduction, Organization	1, 3	6.02
	Learning Objectives (Competencies)	2, 4	
Technology	Technology Issues	5, 6, 7, 8, 20	5.97
	Instructional Design / Web Design	9, 10, 23	
Learning Activities	Communication, Interaction, and Collaboration	12, 13	5.87
	Face-to-Face / Blended Elements	14, 15	
Performance Evaluation	Student Assessment and Feedback	16, 17, 18	5.86
	Learner Support / Instructor Support	11, 21, 26	
Impact	Course Evaluation, Continuous Improvement	19, 22, 24, 25	6.02

In general, the five themes obtained high overall scores, ranging from 5.86 to 6.02. Objectives and Impact are the top-scoring themes, while Learning Activities and Performance Evaluation rank 4th and 5th, respectively.

Theme 1: Objectives

The Objective theme has a mean of 6.02, suggesting that the respondents highly agreed that the course objectively met their relative needs, goals, and expectations of the course, enabling the students to apply their learning and demonstrate their competence. This was further explained qualitatively by the respondents, who similarly stated the course's objectivity. Furthermore, this theme also included subthemes such as preparation, competency, and content.

Table 4. Objectives Subthemes

Objectives Subthemes	Improvement	Engagement	Experience
Preparation	15 (71.43%)	7 (14.00%)	2 (10.53%)
Competency	2 (9.52%)	30 (60.00%)	13 (68.42%)
Content	4 (19.05%)	13 (26.00%)	4 (21.05%)
Total	21 (100%)	50 (100%)	19 (100%)

Preparation

The area requiring the most improvement is the session preparation, showing 71.43% (n = 15) (Table 4). The respondents suggest that the professor assign the virtual patient case prior to the scheduled activity, as setting it up in class consumes the time of the students to answer the given case.

Student engagement is low at 14% (n = 7), as students would like to have formative sessions and discussions of the topics prior to the actual graded activity. Some expressed that they want clearer instructions before answering any virtual patient case.

"Schedule some classes AFTER we take the subject. I find it super annoying when we're just doing the ViP without knowing what we're doing because we haven't learned that topic yet. I learn absolutely nothing when this occurs." (Participant SL-22219-S-169)

Competency

Not much improvement is required for competency at 9.52% (n = 2), as there is a high student engagement at 60% (n = 30). Students would like to keep the virtual patient cases as they are able to apply their knowledge in the given clinical scenarios. The users believe that it provides insight as to which subjects they should focus on. It helps in reinforcing their retained knowledge when answering quizzes, as some of the questions reflected topics encountered in the various cases in the virtual patient sessions.

"I would keep using ViP since it helps in applying the things we've learned in our classes". (Participant SL-22219-S-164)

"Doing ViP scenarios helped me recall important information during the block exams since it was easier to visualize the clinical manifestations and treatment of disease. Since then, I have been engaged further." (Participant SL-22219-S-321)

The majority of the students' experiences regarding competency is at 68.42% (n = 13) (Table 4). While they perceive the sessions as fun and an exciting experience, they are aware that they must take note of the subtleties in the patient's details to give the correct treatment. While some are challenged about the proper sequence in successfully managing the patient, others are thrilled to be able to solve it despite the time limit.

Content

Scores regarding content are relatively neutral in the three areas. Some respondents believe (19.05% n = 4) that the content of cases is confusing as the dosing and the names of the drugs used in the scenarios are different with that of the local clinical practice. Some of the medications are not routinely given in the local setting.

"Our lecture contains management plans; however, in the program, some of the names of the drugs were not available or were in a different name, which adds confusion." (Participant SL-22219-S-108)

While some parts are not applicable to the local settings, the students find the cases challenging but enjoyable, as the content of the cases is highly relevant to practical application.

"The scenarios are very diverse, making us familiarize with different cases across all subjects. The course was a very good introductory in transitioning to clinical practice." (Participant SL-22219-S-339)

Theme 2: Technology

The Technology theme has a mean of 5.97 (Table 3), suggesting that the respondents highly agreed that the course reveals technological aspects concerning the access and use of ViP. Additionally, the students express high engagement with respect to the technological aspect of the course. However, most students recommend further improvement in technology. The subthemes identified under this theme include Virtual Patient System and IT Infrastructure.

Table 5. Technology Subthemes

Technology Subthemes	To improve	Engagement	Experience
IT infrastructure	15 (42.86%)	3 (7.14%)	5 (11.90%)
ViP System	20 (57.14%)	39 (92.86%)	37 (88.10%)
Total	35 (100%)	42 (100%)	42 (100%)

Virtual Patient System

Student responses indicate that 57.14% (n = 20) need to be improved in the ViP system (Table 5). The users encounter several technical difficulties within the app, such as occasional non-recorded sessions, inability to see the grades when feedback was disabled by the professor, and notifications that the case has ended when the student is still answering the session. There are instances wherein the case doesn't end, but the student gets a high mark.

"There were too many technical difficulties that affected my performance (even though I've tested the app the day before)." (Participant SL-22219-S-032)

Despite the technical concerns using the ViP platform, student engagement remains high at 92.86% (n = 39), with additional feedback concerning the system at 88.10% (n = 37).

"This is a good system. Just needs some ironing out of the details. It's really engaging and it 'gamifies' the clinical [aspect] of medicine, which, for me, is really exciting and interactive. I appreciate adding this learning modality to our curriculum." (Participant SL-22219-S-229)

IT Infrastructure

The IT infrastructure has obtained low scores across the three areas of concern, with areas of improvement being the highest at 42.86% (n = 15), followed by other feedback at 11.90% (n = 5), and student engagement at 7.14% (n = 3).

"Ensure that everyone can access ViP and consider the technological limitations of others." (Participant SL-22219-S-009)

The majority of users attribute the technical difficulties to a slow internet connection, which hampers their seamless user experience.

"It is good as part of learning, but there are a lot of technical difficulties, and it demands a lot of technological assistance." (Participant SL-22219-S-292)

The users encounter several technical difficulties while answering clinical cases using a device other than a laptop. While using a different device is acceptable, most users encounter difficulties resulting in delays.

Theme 3: Learning Activities

The Learning Activities theme has a mean of 5.87, indicating that students highly agree that the course presents the process, strategy, or actions to teach and or promote achievement of knowledge and engagement. Further, most students shared their experience in the learning activity and their engagement with the course. However, the call for improvement in the delivery and additional cases was expressed.

Table 6. Learning Activities Subthemes

Learning Activities Subthemes	To improve	Engagement	Experience
Delivery	43 (54.43%)	36 (76.60%)	21 (72.41%)
More Cases	28 (35.44%)	3 (6.38%)	7 (24.14%)
Interaction	8 (10.13%)	8 (17.02%)	1 (3.45%)
Total	79 (100%)	47 (100%)	29 (100%)

Delivery

Delivery plays an important role in the value of the information dissemination employing the ViP platform. Students' engagement was notably high at 76.60% (n = 36), as students enjoyed the new learning modality while finding the sessions enjoyable (Table 6). In this study, 54.43% (n = 43) believe that there needs to be improvement in the integration of the platform into the course. Students believe that a sample demo

session should be provided before the actual graded session to set the expectations. Unlimited attempts and case access after the sessions for a limited time post-session should be observed for actual knowledge retention. More session discussions are requested by the students to focus more on therapeutics and patient management.

"Formative first, then summative. Shorten lectures, then the lecturer should do a ViP sample case demonstrating learning points" (Participant SL-22219-S-086)

Student feedback regarding their experience in the delivery of the ViP accounts for 72.41% (n = 21). They believe that the activity was a good learning experience and hope to have more time allotted to answering the cases.

"I hope there could be more time to answer and try the case". (Participant SL-22219-S-414)

This is an interesting way to learn about the management of specific diseases". (Participant SL-22219-S-436)

More Cases

In terms of improvement, the demand for "more cases" follows delivery at 35.44% (n = 28) of responses. This indicates that offering additional cases or scenarios to practice is also important for enhancing the use of ViP. In parallel to this, 24.14% (n = 7) of responses are shared experiences regarding the need for additional cases.

"I hope there will be more practice sessions where we can explore cases relevant to the course material." (Participant SL-22219-S-023)

In support, there are only 6.38% (n = 3) responses that mention more cases relating to their engagement, signifying that there's a need for more cases.

Interaction

Interaction promotes collaboration among students and enables the sharing of insights during classroom discussions. Among the subthemes under learning activities, interaction receives the lowest responses in terms of necessity for improvement, with 10.13% (n = 8) of responses. Medical students like collaborating and exchanging knowledge with their classmates in doing ViP activities. This signifies that although interaction is good, there is still a need for improvement.

"It's better if the ViP session is team-based in order to enhance the exchange of knowledge." (Participant SL-22219-S-113)

"Doc allowed us to help each other, which helped me learn more." (Participant SL-22219-S-296)

On the contrary, respondents' perception towards interaction and its contribution to their engagement is low at 17.02% (n = 8) and shared experience at 3.45% (n = 1), which implies that the interaction has been less notable for the medical students.

Theme 4: Performance Evaluation

The performance evaluation theme has a mean of 5.86, which reveals that students agreed with the adequacy of the scoring and metrics derived from using the ViP. However, qualitative data suggested that the assessment may be improved when accompanied by instructor guidance to supplement learning and outcomes.

Table 7. Performance Evaluation Subthemes

Performance Evaluation Subthemes	To improve	Engagement	Experience
Feedback	42 (84.00%)	25 (92.59%)	14 (82.35%)
Assessment	8 (16.00%)	2 (7.41%)	3 (17.65%)
Total	50 (100%)	27 (100%)	17 (100%)

Feedback

For the improvement of performance evaluation, feedback stands out as the most critical aspect, with a significant 84% (n = 42) of responses indicating it requires attention (Table 7). This suggests that respondents perceive feedback as inadequate and in need of enhancement.

"Please provide immediate personal feedback after doing the online activity to improve the next sessions and learn properly from mistakes." (Participant SL-22219-S-057)

In terms of engagement, a substantial 92.59% (n = 25) of respondents indicate that feedback from their professor plays a crucial role in enhancing engagement and excitement.

"Doing the physical exam on the patient and making the patient live. I think good feedback and simulation of what should be done could improve my learning to know what I should have done instead." (Participant SL-22219-S-400)

There are 82.35% (n = 14) of respondents who mention their additional experience related to providing feedback.

"It was a fun experience using this. I was very anxious at first, but when I learned how to navigate through it, I was less scared. I am glad that it contributed to my learning, and I hope to translate these into actual knowledge and skills when I get to clerkship. I also commend the admin for being so responsive and our professor for being patient with us." (Participant SL-22219-S-503)

Assessment

Respondents believe that the overall score in ViP should be visible on their end if it would help them evaluate themselves. Assessment follows as 16% (n = 8) of responses, indicating that while it is important, students appeared to place greater emphasis on feedback.

"I think at least showing our overall score would help us gauge how much more we need to do in terms of completing the tasks needed in ViP." (Participant SL-22219-S-187)

In regard to the contribution of assessment in the students' engagement and excitement, it accounts for only 7.41% (n = 2), suggesting that, although assessment remained important, students placed greater emphasis on feedback in this regard. Likewise, to the results of engagement and improvement, only 17.65% (n = 3) of responses mentioned their thoughts on assessment in their additional feedback, indicating that they are primarily focused on receiving feedback but not entirely disregarding the assessment result of ViP.

Theme 5: Impact

The Impact theme has a mean of 6.02. This suggests that students perceived the use of ViP in the course as having a meaningful influence on their perspectives regarding the learning unit and patient management. This is further supported qualitatively by the high percentage of students who described their experiences and engagement with the realism of the ViP.

Table 8. Impact Subthemes

Impact Subthemes	To improve	Engagement	Experience
Realistic	2 (50.00%)	34 (77.27%)	4 (100%)
Patient Management	2 (50.00%)	10 (22.73%)	0 (0.00%)
Total	4 (100%)	44 (100%)	4 (100%)

Realistic

In terms of impact, realistic aspects account for 50% (n = 2) of responses that suggest improvement (Table 8). A high percentage of responses, 77.27% (n = 34), agree that ViP is realistic and it substantially contributes to their engagement, indicating that participants value authentic and relatable experiences in their engagement efforts.

"It's great that it can really somehow simulate a real-life scenario of managing the patient. The element of urgency to solve the cases was a big factor in forcing me to think fast but in a logical manner as well." (Participant SL-22219-S-227)

"I think ViP makes for a good experience to actually put what we learn into practice without the fear of actually killing the patient." (Participant SL-22219-S-273)

Some responses describe how realistic ViP are in terms of their additional experience.

"I felt extreme joy because I felt like I was treating a real patient." (Participant SL-22219-S-447)

Patient Management

While the respondents perceive the ViP as a realistic and engaging tool, 50% (n = 2) suggested further enhancements in patient management features to better support their learning.

"Having a ViP case for the clin(inical) integ(ration) subject was a refreshing touch to the usual paper cases we've had in our previous cases. It gave us a feel of how to actually handle a patient and write a management plan for the patient." (Participant SL-22219-S-161)

A total of 22.73% (n = 10) of respondents found the platform engaging in terms of patient management.

"The ability to manage an actual patient, albeit virtually, incites excitement and provides us insight into our future work as physicians." (Participant SL-22219-S-328)

DISCUSSION

The ETELM-LP survey results (Table 1) indicate that students generally perceived virtual patient platforms positively in supporting their learning. The highest-rated items were related to the absence of culture- or language-related barriers and the relevance of course objectives to learners' needs. In contrast, lower ratings were observed in areas related to technical issues and inadequate feedback on students' learning progress, highlighting potential areas for improvement.

To further explore these perceptions, a thematic analysis was conducted to provide deeper insight into students' experiences.

The themes identified in this study, namely objectives, technology, learning activities, performance evaluation, and impact, were developed through the structured thematic analysis framework illustrated in Figure 2. This approach ensured consistency in data interpretation and captured students' experiences using virtual patient platforms across different learning settings, including lectures and clinical rotations.

Objectives are an integral part of learning as it outlines the knowledge, skills, and competencies that the learners will obtain after an educational activity.¹² A carefully planned objective requires ample preparation to execute the learning session properly. This includes considering the materials and digital platform that will be used, the number of learners attending the session, the internet connection, and the method that will be used to execute the knowledge transfer. In this study, objectives are one of the highly marked themes aside from impact, with a mean score of 6.02 (Table 3). This score aligns with the 11.11% (n = 21) (Table 2) in the

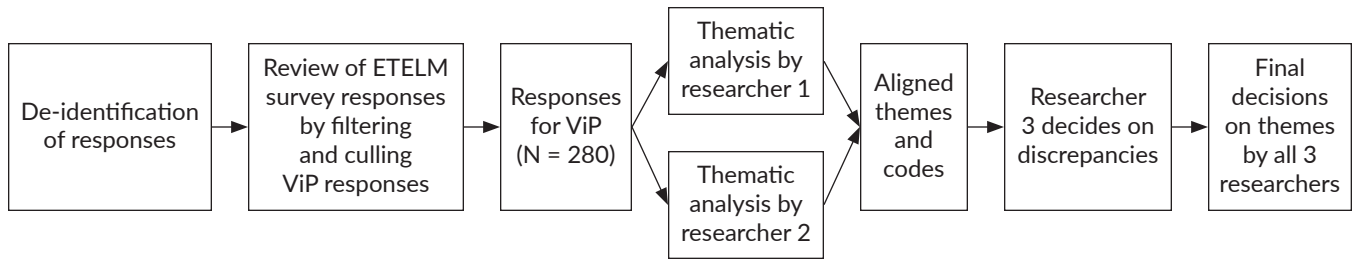


Figure 2. Framework for collecting data, conducting blinded thematic analysis, and maintaining response anonymity.

ETELM-LP open-ended questions, indicating that only a few improvements are needed in this theme. This signifies the effective presentation of the objectives of the course.

The subthemes under Objectives, which are competency, preparation, and content, show that preparation has the highest priority for improvement; it has a lower score for its student engagement and experience. Some factors why there is a lot to improve in the preparation include (1) the learning curve to navigate the platform and (2) the professors' familiarity with the software, which is influenced by the frequency of its use in their lectures. A carefully planned objective enables learners to be prepared for the learning activity as it sets the expectation about the course overview and assessment.¹²

The responses showed that the ViP is engaging, as it challenges their theoretical knowledge and enables them to improve their competencies. While the content of the platform is not completely aligned with the local management guidelines, the simulation is an added learning material to strengthen their foundational knowledge.

Technology has been utilized in medical education and has been rapidly advancing to meet the demands and changing trends of the growing field. It has been a powerful tool to support the students' learning, especially in circumstances where unforeseen events occur. Our institution started using the ViP during the time of the pandemic, when there was a nationwide lockdown, but the academic learning needed to continue. The use of the platform was maintained when the restrictions were lifted. Findings of this study, based on the ETELM-LP responses, show that the mean for technology is 5.97 (Table 3). A significant portion of the responses to the open-ended questions in the ETELM-LP, 37.84% ($n = 42$) (Table 2), whether positive or negative, are linked to experiences with ViP or IT infrastructure in relation to this theme. The ViP and the IT infrastructure have a recommendation for improvement at 57.14% ($n = 20$) and 42.86% ($n = 15$) (Table 5), respectively. At the time of the data collection, the system had limitations in terms of device compatibility, web accessibility, internet connectivity issues, and user experience concerning effective case management and how grades were obtained and presented.

Interestingly, despite these identified areas for improvement, the Virtual Patient System continued to demonstrate high student engagement, whereas the Information Techno-

logy Infrastructure reflected comparatively lower emphasis among respondents.

Several published studies mention that simulation is one modality for experiential learning that represents realistic situational activities in delivering medical needs to a ViP.^{13,14} Correspondingly, the respondents of this survey consider the simulation activity and the clinical scenarios in the platform to be realistic and interactive. The users appreciate that the ViP is engaging as each step, and every minute plays a critical role in the overall health of the ViP. According to literature, the use of technology augments knowledge transfer, improves clinical skills and clinical reasoning skills, thereby promoting learning without harming the patient.¹³

Learning Activities and Performance Evaluation had mean scores of 5.87 and 5.86, respectively, among the five themes based on the ETELM-LP (Table 3). These two are interconnected since the effectiveness and reinforcement of learning activities require ample feedback and strong performance evaluation. In relation to the open-ended questions of the ETELM-LP, both learning activities (41.80% $n = 79$) and performance evaluation (26.46% $n = 50$) (Table 2) have obtained high scores for areas needing improvement, which aligns with the low mean score for these two teams. Based on the responses of the survey, the students enjoy the new modality of teaching and learning compared to the traditional method; however, some improvements can be employed. As the ViP is versatile and can be applied to teaching in different ways, there are various approaches on how professors integrate the platform into their lectures. It is also important for professors to understand the learning needs of their students in order to adapt teaching methods that are both necessary and effective. Several studies have mentioned that students find it difficult to transition from classroom-based learning to ward duties, which also remains a challenge for the educators, despite preparation with early patient encounters and clinical skills training.¹⁵⁻¹⁸

As shown in Table 6, student responses noted a need for better integration of the ViP platform into the course while also recognizing the activity as a valuable learning experience. Students also expressed a desire for more sample cases for practice, as well as additional time to complete each case. These findings indicate that the implementation of ViP activities, particularly in terms of course integration, delivery, availability of practice cases, and adequate time allocation,

remains an important consideration in learning activities.

The findings of this study show that medical students are eager to learn and prefer a formative session at the start of the class, followed by a summative session, with discussions conducted after both sessions. In another study by Mestre et al., the researchers showed that small group discussions associated with ViP sessions are beneficial for students' learning of both theoretical and clinical skills.¹⁹ This is supported by our results, which show a high preference for teamwork and group collaboration, especially during team-based learning activities, clinical integration, and small group discussions. By using the ViP, students can exchange ideas, learn from their peers, and develop soft skills such as leadership, conflict resolution, communication, and time management.

Performance evaluation, through instructor session feedback, enhances the reinforcement of active learning, as the students are able to understand concepts and how to approach each case in the ViP. The majority of the student respondents preferred faculty demonstration on how to approach a ViP clinical scenario, followed by points for clarification. As shown in Table 7, students placed greater emphasis on receiving feedback while still recognizing the value of assessment results from the ViP. Although there is considerable room for improvement in giving effective feedback, the students anticipate debriefing sessions to gain a better understanding of the case outcomes.

Impact reflects the effectiveness of the learning process and performance evaluation across each learning session. In the ETELM-LP domains, this theme obtained a mean score of 6.02 (Table 3). This finding aligns with the 2.12% ($n = 4$) (Table 2) score in the open-ended questions of the ETELM-LP, indicating that only a few improvements are necessary in this theme. The students find the ViP realistic and interactive, as the experience of emulating the role of healthcare providers and giving treatment to a patient without harming them entices their excitement and engagement. As shown in Table 8, under the theme of impact, the subthemes of realism and patient management further illustrate how the ViP platform supports student engagement, particularly in knowledge application and experiential learning. Students tend to learn more effectively when they are actively involved, as this encourages greater focus and engagement during the learning process.

Looking through the lens of the SAMR framework, the results of this study highlight that the use of the ViP in our institution falls under the Augmentation level. From the traditional methods of teaching, the integration of technology has led to some functional improvement. It bridges the gap from not encountering important must-know cases in the clinical settings to using the ViP to experiencing and immersing oneself in how to attend to these virtual clinical settings.

Limitations of the Study

This study focused on data collected between 2023 and 2024, based on the version of the ViP platform available during that period. It centers on the perspectives of medical students regarding their experiences with the platform and does not include insights from faculty members, platform administrators, or institutional staff. The study does not assess students' clinical competence or academic performance.

The use of the ViP platform in the institution differs from practices in other medical schools worldwide. Each has its own technological setup, as some are more advanced, while others are still in the process of fully integrating and adapting to the ViP learning tool. Within the current setting, the ViP platform operates as a stand-alone system and is not yet connected to the institution's learning management system. The study is limited to medical schools that currently utilize virtual patient platforms. The findings may also be useful for institutions planning to adopt virtual patient software.

While the ViP software that was evaluated may not be the most commonly used platform worldwide, the ETELM tool has common categories that will allow transferability of findings. Categories such as curriculum, learning objectives, technology issues, instructional design, etc., are generic enough to be applicable to other ViP. In fact, ETELM was designed to be applicable for most, if not all, technology-enabled learning modalities. The student comments on things to improve, things that they liked, and their overall comments can apply to many other online platforms.

CONCLUSION

The use of ViP in medical students' learning courses garnered highly positive perceptions based on their experience. However, some improvements in the delivery, feedback, and technical aspects must be made. The students perceive this innovation as a valuable opportunity to enhance their learning, while the professors can analyze the students' metrics and focus on points that need more feedback. Overall, the professor should be able to gauge the learning needs of their students and tailor their approach to achieve an optimal learning outcome and engagement. Further research is needed to establish its effectiveness as a complementary tool alongside in-person clinical teaching to assess how the ViP can enhance the overall learning experience of the students.

Recommendations

Based on the findings and conclusions, the researchers hereby recommend the following:

As this study did not include data on the information technology (IT) literacy of participants, future research is encouraged to assess users' digital proficiency when engaging with educational technology platforms, particularly the ViP platform. Differences in IT literacy may influence learners' perceptions of usability, ease of navigation, and overall engagement with the ViP system.

It is recommended to conduct more faculty development

programs regarding the ViP preparation and use, and to provide feedback when discussing the clinical scenarios. This will emphasize the platform's usage benefits and strengthen its role in student engagement to benchmark the emerging trends of learning in medical education across different subjects.

The findings of this study offer valuable insights and information to school administrators regarding the challenges in the IT infrastructure, specifically the institution's internet connection. At the time of writing, this study highlights certain areas for improvement in both the ViP platform and IT infrastructure, which may or may not have been addressed by the time of publication. Future enhancements, especially regarding aligning some of the content and clinical scenarios with the Philippine Clinical Practice Guidelines, would increase user engagement and motivation to use the platform more frequently.

The administrator of the ViP may strengthen their expertise by updating knowledge on how to deliver programs and be aware of the current trends regarding simulation, finding inspiration from other medical schools on how they implement ViP use when joining webinars, and lastly, collaborating and networking with other users of the ViP globally.

Additional suggestions included maintaining an updated virtual patient system and integrating artificial intelligence features to further improve platform interactivity with students. During the period of data collection and manuscript preparation, these features were not yet incorporated into the ViP platform. Their subsequent integration may provide additional opportunities to enhance the student learning experience.

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