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Teaching Innovations in Public Health Education: Integrating Simulation and Case-Based Learning

Maria Helena[1], Theresa Cecilia[1], Agnes Kristina[1]

[1]*Fakultas Keperawatan, Universitas Katolik Widya Mandala Surabaya*

**Corresponding Author: Maria Helena*

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Abstract

This study explores the integration of simulation-based learning (SBL) and case-based learning (CBL) in public health education, emphasizing their impact on student engagement, critical thinking, and collaborative skills. Using a qualitative phenomenological design, the research involved 20 undergraduate students and 5 educators selected purposively to represent diverse experiences. Data were gathered through interviews, focus group discussions, and reflective journals, then analyzed thematically to identify key patterns. Findings show that SBL promotes active participation, decision-making, and reflective learning, while CBL strengthens analytical reasoning, evidence-based problem-solving, and the application of theory to real situations. Educators noted that implementing these approaches requires structured planning, guidance, and feedback but yields substantial benefits for learning outcomes and teamwork. Despite challenges such as time constraints, limited resources, and student anxiety, both groups acknowledged the transformative role of SBL and CBL in developing essential public health competencies. The study highlights the need to embed experiential and case-driven strategies in curricula to better prepare graduates for complex real-world challenges and calls for stronger support in curriculum design and faculty development to advance active learning in public health education.

INTRODUCTION

Public health education is undergoing a paradigm shift, emphasizing interactive and experiential learning strategies to prepare students for increasingly complex health challenges (Tar et al., 2024; Adeyele, 2024). Traditional lecture-based instruction, while foundational, often falls short in developing the practical skills, critical thinking, and decision-making abilities required in real-world public health settings (Pham et al., 2023). In response, educational innovations such as simulation-based learning (SBL) and case-based learning (CBL) have emerged as effective pedagogical strategies that foster active engagement, applied learning, and professional competence. Simulation-based learning uses realistic scenarios to replicate public health challenges, enabling students to practice clinical reasoning, problem-solving, and collaborative decision-making in a safe, controlled environment (Elendu et al., 2024). Studies have consistently demonstrated that SBL enhances both knowledge acquisition and practical skills, providing learners with immediate feedback and opportunities for reflective practice (Bahattab et al., 2023). In public health education

specifically, simulations can include outbreak management, emergency response, health policy implementation, and community health interventions, all of which allow students to translate theoretical concepts into practical actions (O'Shea et al., 2022). Furthermore, SBL has been linked to increased learner confidence and preparedness, fostering resilience in complex decision-making situations (Dias et al., 2022).

Case-based learning (CBL) serves as a complement to the simulation-based learning (SBL) showing students real-life or hypothetical problems in the field of public health that require critical thinking and problem-solving and decision-making (Saleem and Khan, 2023). CBL stimulates the active interest in reading, the ability to think about the various sides and the use of evidence-based arguments to find the solutions (Khalid et al., 2023). The existing body of empirical evidence shows that CBL enhances analytical capabilities, knowledge retention, and professional competence in students of the field of public health (Wang and Ji, 2021). Additionally, CBL promotes teamwork, communication, and leadership, which is vital in resolving multidisciplinary problems related to public health (Astbury et al., 2021). However, the commonly used traditional CBL methods are quite instructor-centered and might not involve full engagement of students unless they are specifically designed to facilitate active learning and responsibility (Alinier & Oriot, 2022).

Simulation and case-based learning integration is a new pedagogical approach that will integrate the advantages of the two approaches to provide a more comprehensive learning experience (Moslehi et al., 2022). The simulations installed into case studies put the students into situations that are realistic and require them to apply what they learned in theory and practice. This combination allows the learners to be experimental, to make decisions under pressure, and reflect on the outcomes of their behavior and as a result improve critical thinking, problem-solving and applied competence. Additionally, combined SBL and CBL methods promote cooperation and discussion, which are the characteristics of multidisciplinaryness of the public health practice.

Although all of these approaches have been reported to have positive effects on their respective subsystems, few quantitative studies explore how SBL and CBL can be used together to achieve positive learning outcomes in the public health education context (Alharbi et al., 2024). The majority of studies in the field are qualitative, considering the perceptions, experience, or satisfaction of students but not objective knowledge, skills acquisition, and problem-solving performance (Sultana et al., 2024). They require quantitative research that will guide curriculum design and instructional practices by giving empirical data on the effectiveness of the integrated approaches (Zhang and Hu, 2024).

Considering the intricacy of the modern health issues in the community, teachers need to implement teaching schemes that equip students to translate theoretical lessons into practical application of the theoretical content, think critically, and collaborate (Vinokur et al., 2023). The combination of SBL and CBL is a potentially effective solution to these goals, as it will incorporate an experiential model of learning, active involvement, and problem-solving in a scenario (Alexander et al., 2024). The paper is a quantitative analysis of the efficacy of combining simulation and case-based learning in delivering education in public health in an attempt to offer evidence-based suggestions on perfecting the teaching and learning models. Assessing the knowledge acquisition, skill development, and performance on problem-solving in a systematic way, the research adds to the accumulating evidence of the new approach to pedagogy in health education.

METHODS

This study employed a qualitative phenomenological design to explore the lived experiences of public health students and educators involved in simulation-based learning (SBL) and case-based learning (CBL). Phenomenology was selected to gain an in-depth understanding of participants' perspectives, experiences, and the meaning they attach to engaging in these teaching innovations (Creswell & Poth, 2018). The design allowed the researchers to capture nuanced insights into how these methods influence learning, problem-solving, collaboration, and practical skill development, which cannot be fully quantified through numerical measures.

Participants

Participants were selected using purposive sampling to ensure a rich and diverse set of experiences. The study included 20 undergraduate students enrolled in the Public Health program and 5 educators who facilitated SBL and CBL sessions. Inclusion criteria for students required participation in at least one full cycle of simulation and case-based learning activities, while educators were included based on direct involvement in planning and implementing these interventions. Participants were chosen to represent a variety of academic performance levels, prior exposure to innovative teaching, and demographic diversity, enhancing the depth and credibility of the findings.

Data Collection

Data were collected using a combination of semi-structured interviews, focus group discussions, and reflective journals to capture a comprehensive understanding of participants' experiences with simulation-based learning (SBL) and case-based learning (CBL). Semi-structured interviews were conducted individually with both students and educators to explore personal experiences, perceptions of learning effectiveness, challenges encountered, and perceived benefits of the interventions. Open-ended questions encouraged participants to provide detailed, reflective responses that revealed the depth and complexity of their experiences. In addition, focus group discussions were held with students to facilitate interactive dialogue, allowing them to share and reflect on collective experiences, collaborative learning, and peer interactions during the SBL and CBL sessions. To complement these verbal accounts, reflective journals were maintained by students throughout the six-week intervention, documenting their reflections on learning processes, problem-solving strategies, and skill development. All interviews and focus groups were audio-recorded and transcribed verbatim, and observational notes from classroom and simulation sessions were incorporated to supplement self-reported data. The integration of these multiple data sources enabled triangulation, enhancing the credibility, depth, and trustworthiness of the study's findings.

Data Analysis

Data were analyzed using thematic analysis. First, transcripts were read repeatedly to ensure familiarization with the data. Next, meaningful codes were generated for significant statements and patterns related to experiences, perceptions, and challenges. These codes were then organized into broader themes representing the essence of participants' experiences. Themes were reviewed iteratively to ensure coherence, relevance, and alignment with research objectives. Each theme was defined and named, and illustrative quotes were selected to substantiate the findings. Data management and coding were facilitated using NVivo 14, ensuring systematic organization, retrieval, and transparency in analysis.

RESULTS AND DISCUSSION

Prior to presenting the findings, it is essential to contextualize the study within the framework of teaching innovations in public health education, specifically focusing on simulation-based learning (SBL) and case-based learning (CBL). These pedagogical strategies are designed to actively engage students in experiential learning, promoting critical thinking, problem-solving, and collaborative skills that are crucial for effective public health practice. The data collected from students and educators provide rich insights into the lived experiences, perceptions, and challenges associated with these innovative teaching methods. By exploring students' engagement, participation, analytical reasoning, and educators' facilitation experiences, the study illuminates how SBL and CBL function as complementary strategies that bridge theoretical knowledge and practical application. The subsequent results are organized thematically to reflect these dimensions, offering a comprehensive understanding of the impact and implications of integrating SBL and CBL into public health curricula.

Students' Perceptions Of Learning Engagement And Participation In SBL

Students reported that simulation-based learning (SBL) significantly enhanced their engagement and active participation in public health education. Many described the simulations as "realistic and immersive," which made learning more interesting and meaningful compared to traditional lectures. One student stated,

> *"During the outbreak management simulation, I felt like I was really in a public health emergency. I had to make decisions quickly and think about the consequences of each action. It made me more alert and involved than just reading from a textbook."*

Several participants highlighted that SBL encouraged active decision-making and critical thinking, as they were required to apply theoretical knowledge to practical scenarios. Another student emphasized,

> *"I liked that we were not just observing; we had to participate fully. I had to discuss strategies with my group, prioritize tasks, and even defend our decisions. It made me feel like a real public health professional."*

Collaboration emerged as a central theme in students' perceptions. They reported that SBL sessions fostered teamwork and peer learning, as decisions were often made collectively. One participant reflected,

> *"Working in teams during the simulation was very engaging. We had to communicate, listen to each other, and compromise. I learned a lot from seeing how my peers approached problems differently."*

Students also noted that the immediate feedback and reflective discussions after simulations enhanced their learning experience. Feedback sessions allowed them to recognize mistakes, refine strategies, and deepen understanding of public health principles. A student explained,

> *"After the simulation, the debrief helped me see where I went wrong and how I could improve next time. It was not just about doing it once; it was about learning from each experience."*

Despite the generally positive experiences, a few students mentioned initial anxiety or hesitation when first participating in simulations, particularly due to the pressure of decision-making in a controlled, realistic environment. However, most indicated that this discomfort decreased over time and ultimately contributed to increased confidence and engagement. Overall, students perceived SBL as a highly engaging and participatory learning method that stimulated critical thinking, collaborative

problem-solving, and practical application of public health knowledge. The combination of realistic scenarios, teamwork, and reflective feedback was consistently highlighted as key to enhancing their active participation and learning engagement.

Impact Of CBL On Critical Thinking And Problem-Solving Abilities

Students reported that case-based learning (CBL) significantly contributed to the development of their critical thinking and problem-solving skills. By engaging with real-life or hypothetical public health cases, participants were required to analyze complex situations, identify core issues, and propose evidence-based solutions. One student explained,

> *"Working on the case about community vaccination programs forced me to think critically. I had to evaluate data, consider the community's needs, and come up with a plan that actually made sense. It was challenging, but it made me feel like I was applying theory in a real situation."*

Many students highlighted that CBL promoted analytical reasoning by requiring them to dissect problems into smaller components and systematically evaluate options. A participant shared,

> *"Each case presented multiple problems at once. I had to prioritize which issue to address first and justify my decisions with evidence. It definitely improved how I approach problems now."*

Collaboration also emerged as a key factor in enhancing problem-solving abilities. Students reported that discussing cases in groups encouraged them to consider diverse perspectives and refine their strategies collectively. One student reflected,

> *"We had to debate solutions with my group. Listening to different opinions helped me see gaps in my own reasoning and pushed me to think more deeply before making a decision."*

Another notable impact of CBL was the connection between theory and practice. Students frequently mentioned that working through cases helped them understand how theoretical concepts could be applied to public health challenges in practical settings. A student noted,

> *"Before, some concepts in lectures felt abstract. But when we analyzed real cases, I could see how they actually play out in the field. It made me think more critically about every decision."*

While most students described the experience as positive, a few reported initial difficulty in navigating ambiguous case information and uncertainty in decision-making. However, participants acknowledged that this challenge ultimately strengthened their problem-solving confidence. As one student observed,

> *"At first, it was overwhelming because cases didn't have one clear answer. But I learned to weigh evidence, consider alternatives, and make justified decisions, which I think is really important for public health practice."*

Overall, students perceived CBL as a highly effective pedagogical method for developing critical thinking and problem-solving competencies. The combination of real-world scenarios, collaborative discussion, and the requirement to apply evidence-based reasoning enabled students to actively engage with complex public health problems and refine their analytical and decision-making skills.

Educators' Experiences In Facilitating Innovative Teaching Methods

Educators reported that facilitating simulation-based learning (SBL) and case-based learning (CBL) was both rewarding and challenging, offering unique opportunities to

enhance students' engagement, critical thinking, and practical skills. Many described the experience as highly interactive, requiring them to adopt a facilitative rather than purely didactic role. One educator explained,

> *"In SBL and CBL sessions, I'm not just lecturing; I'm guiding students through problem-solving. It's about asking the right questions and helping them reflect on their decisions rather than giving them the answers."*

Facilitators emphasized the importance of planning and designing realistic scenarios that are both engaging and pedagogically meaningful. Educators noted that simulations required careful structuring to mimic real public health challenges while maintaining a manageable learning environment. One participant shared,

> *"Designing simulations takes a lot of preparation. We have to anticipate student responses, create realistic scenarios, and ensure that learning objectives are clear. But when it works, seeing students actively engage is incredibly satisfying."*

Similarly, in CBL, educators highlighted the challenge of balancing guidance with autonomy, allowing students to explore multiple solutions while maintaining focus on critical learning outcomes. As one educator stated,

> *"With case-based learning, I have to step back sometimes and let students struggle with ambiguity. It's uncomfortable for them at first, but it encourages independent thinking and strengthens problem-solving skills."*

Another key theme was the observed growth in students' collaboration and communication skills. Educators consistently reported that both SBL and CBL fostered teamwork, negotiation, and peer learning, which are essential competencies in public health practice. One facilitator noted,

> *"Watching students discuss, debate, and defend their strategies during simulations or case discussions is rewarding. They're learning not only the content but also how to work effectively as a team, which is critical in public health."*

Despite these benefits, educators also mentioned challenges in implementation, particularly regarding time constraints, resource availability, and varying levels of student readiness. One educator reflected,

> *"Not all students are immediately comfortable with these methods. Some need more support, and sometimes the logistics like space, materials, and time can be limiting. But the benefits far outweigh the challenges."*

Educators perceived SBL and CBL as highly effective teaching strategies that enhance student engagement, critical thinking, and practical application of public health concepts. They emphasized that successful facilitation requires careful planning, adaptability, and ongoing reflection to optimize learning outcomes and address diverse student needs.

This study aimed to investigate the integration of simulation-based learning (SBL) and case-based learning (CBL) into public health education, focusing on their impact on students' critical thinking, problem-solving abilities, and overall engagement. The findings underscore the transformative potential of these pedagogical innovations in bridging the gap between theoretical knowledge and practical application, thereby enhancing the quality of public health education.

The integration of SBL and CBL has been shown to significantly bolster students' critical thinking and problem-solving skills. Simulation-based education, through its immersive and interactive nature, allows students to engage in realistic scenarios that require immediate decision-making and reflective thinking. Studies have

demonstrated that such experiential learning environments foster the development of clinical reasoning and judgment, essential competencies in public health practice (Passarelli & Kolb, 2023). Similarly, CBL encourages students to analyze complex cases, synthesize information, and propose evidence-based solutions, thereby cultivating analytical skills and a deeper understanding of public health issues (Amigó & Lloyd, 2021).

These findings align with existing literature that emphasizes the efficacy of active learning strategies in enhancing cognitive skills. For instance, a meta-analysis by Alabi (2024) highlighted the positive impact of problem-based learning on nursing students' critical thinking abilities. The current study extends this body of knowledge by demonstrating the applicability of these methods in public health education, suggesting that SBL and CBL can serve as effective tools for developing critical competencies in this field.

Student engagement is a critical determinant of learning outcomes. The results of this study indicate that SBL and CBL significantly enhance student engagement by promoting active participation, collaboration, and motivation. The interactive nature of simulations and the real-world relevance of case studies captivate students' interest and encourage deeper involvement in the learning process. This is consistent with findings from previous research, which have reported increased student engagement and satisfaction when employing active learning strategies (Alqasa & Afaneh, 2022). Moreover, the collaborative aspect of these teaching methods facilitates peer learning and the development of communication skills. Students working in teams during simulations and case discussions learn to negotiate, share perspectives, and collectively solve problems, thereby mirroring the collaborative dynamics prevalent in public health practice. Such experiences are invaluable in preparing students for the interdisciplinary nature of public health work, where teamwork and effective communication are paramount.

For educators, the adoption of SBL and CBL necessitates a shift from traditional didactic teaching to a more facilitative role. Educators must design and implement scenarios that are not only realistic but also aligned with learning objectives and assessment criteria. This requires careful planning, creativity, and an understanding of the complexities inherent in public health issues. The study's findings suggest that educators who embrace these innovative teaching methods can foster a more dynamic and responsive learning environment, thereby enhancing the educational experience for students.

Curriculum designers should consider integrating SBL and CBL into public health programs to promote experiential learning and the development of practical skills. The incorporation of these methods can bridge the gap between theoretical knowledge and real-world application, ensuring that graduates are well-equipped to address the multifaceted challenges of public health practice. However, it is essential to provide adequate training and support for educators to effectively implement these teaching strategies and to ensure that resources are available to facilitate their use.

Despite the evident benefits, the implementation of SBL and CBL is not without challenges. Educators in this study identified several barriers, including limited resources, time constraints, and resistance to change. These challenges are consistent with those reported in the literature, where the adoption of innovative teaching methods often encounters institutional and logistical obstacles (Munna & Kalam, 2021; Fisher et al., 2021; Nysveen et al., 2022).

To overcome these barriers, institutions must invest in faculty development programs that equip educators with the skills and knowledge necessary to design and facilitate SBL and CBL effectively. Additionally, administrative support is crucial

in providing the resources and infrastructure needed to implement these teaching methods. Collaborative efforts among faculty, administrators, and policymakers are essential to create an environment conducive to the adoption of innovative teaching strategies.

The integration of SBL and CBL into public health education has significant policy implications. Educational policies should encourage the adoption of active learning strategies and provide incentives for faculty to engage in innovative teaching practices. Furthermore, accreditation bodies should recognize and value the incorporation of SBL and CBL in curriculum design and assessment (Bradley et al., 2023). Future research should explore the long-term impact of these teaching methods on graduates' performance in public health practice. Longitudinal studies can provide insights into how the competencies developed through SBL and CBL translate into real-world effectiveness. Additionally, research should investigate the scalability of these methods across diverse educational settings and populations to determine their generalizability and adaptability.

CONCLUSION

This study demonstrates that integrating simulation-based learning (SBL) and case-based learning (CBL) in public health education significantly enhances students' critical thinking, problem-solving abilities, and engagement, while also fostering collaborative skills essential for real-world practice. Educators' experiences highlight the importance of thoughtful scenario design, facilitative teaching, and reflective feedback in maximizing learning outcomes, although challenges such as resource limitations and initial student anxiety must be addressed. The findings underscore the value of active, experiential pedagogies in bridging the gap between theory and practice, suggesting that educational institutions and policymakers should prioritize the adoption of SBL and CBL to cultivate competent, confident, and adaptable public health professionals capable of addressing complex health challenges effectively.

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