

Cultivating Excellence from Experience through Reflective Practice in Nursing Education

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ABSTRACT

OBJECTIVE: This study aimed to understand nursing students' experiences to strengthen reflective practice and prepare graduates for safe, ethical, and patient-centered care.

METHODOLOGY: A qualitative study using a generic qualitative design was conducted with 10 undergraduate nursing students from Years 2 to 4 in one of the universities in Malaysia. Participants were selected via purposive sampling. Data were collected from April to July 2025 through semi-structured, face-to-face interviews using an interview guide and each lasting 30–45 minutes. The data was analyzed using Braun and Clarke's thematic analysis.

RESULTS: Two main themes emerged from the data. The first theme, students' engagement with reflective practice, comprised three subthemes: (a) understanding of reflective practice, (b) application of reflective practices and (c) barriers to effective reflection. The second theme, reflective practice as a catalyst for professional development, included four subthemes: (a) cultivating accountability through reflection, (b) translating reflective practice into clinical competence, (c) enhancing interpersonal skills and emotional resilience, and (d) strengthening critical thinking and ethical decision-making.

CONCLUSION: The findings from this study may inform global nursing education strategies related to reflective practice in preparing nurses to meet the complex demands of modern healthcare.

KEYWORDS: Cognitive reflection, nursing education, students, professional competence, clinical competence

INTRODUCTION

Reflective practice is widely recognized as a cornerstone of professional development in healthcare, particularly nursing. It is a process in which individuals critically examine their experiences, assumptions, and responses to improve understanding, competence, and effectiveness in educational and professional contexts¹. This process helps practitioners integrate theoretical knowledge with clinical experience, refine judgment, and improve patient care². Reflection also increases self-awareness among healthcare professionals (HCPs), helping them identify substandard care and continuously improving clinical practice³.

In nursing education, reflective practice is increasingly recognized as an essential curricular element for developing nurses who are technically skilled, compassionate, adaptable, and ethically grounded⁴. Through structured reflection, students connect theory

with clinical practice and apply classroom knowledge to patient care⁵. Reflection also strengthens critical thinking, clinical judgment, and professional growth. It enables nursing students to manage complex situations, improve decision-making, identify areas for improvement, and develop self-awareness for safe and empathetic practice^{6,7}.

Various strategies have been employed to support reflective practice in nursing education, including journaling, narrative reflection, peer discussion, and critical analysis of case studies or simulations^{8,9}. It has been shown that these structured strategies enhance self-regulated learning, procedural accuracy, and confidence in clinical skills⁹. Educator-guided group reflection also helps students engage in collaborative problem-solving¹⁰. Ultimately, reflection has been found to improve communication skills, empathy, and the ability to provide person-centered care and to make ethical decisions among nursing students¹¹.

Nurse educators play a key role by modelling reflective behaviors and integrating reflective strategies into their teaching^{12,13}. This process benefits both students and educators, as reflection on teaching improves instructional effectiveness and fosters a supportive learning environment^{12,14}.

Despite its well-documented benefits, reflective practice in nursing education remains challenging. Many students have only a superficial understanding of meaningful reflection, limiting its depth and impact¹⁵. Time constraints in demanding nursing programs further reduce opportunities for reflection as students manage academic workloads, clinical

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doi: 10.22442/jlumhs.2026.01538



placements, and personal responsibilities¹⁶. Additionally, emotionally distressing clinical experiences may overwhelm students and nurses and discourage reflection¹⁷. At the institutional level, limited structured support or mentorship makes it harder for students to link reflection to practical learning outcomes^{13,18,19}.

In the Malaysian context, reflective practice is incorporated into certain nursing courses. Recent studies have explored its application in local settings, including the development and evaluation of modules and strategies to support nursing students' reflective skills^{19,20}, as well as reflective practice among nurses and nursing educators^{7,13}. However, few studies have explored how undergraduate students perceive and engage in reflective practice within a structured educational setting. Moreover, most published literature is drawn from Western or high-income healthcare contexts, limiting understanding of how Malaysia's cultural values, educational structure, and clinical training environments shape reflective learning. Therefore, this study aimed to explore Malaysian undergraduate nursing students' experiences and perceptions of reflective practice. It examined how students engage in reflective practice in their learning, the related factors, and its perceived benefits.

METHODOLOGY

Study Design and Participants

A qualitative study employing a generic design was conducted to enable in-depth exploration of their personal and professional insights and subjective interpretation, which aligns with the study objectives.

Purposive sampling was employed to recruit 10 undergraduate nursing students from years 2 to 4, of the overall population of 410 students, from one of the public universities in Malaysia. First-year students were excluded due to limited exposure to clinical practice and reflective activities. All selected participants had completed at least two semesters of theoretical and clinical placement, providing relevant experience with reflective practice. Inclusion criteria required participants to be undergraduate nursing students from years 2 to 4, able to communicate in either Malay or English, and willing to provide consent. Participants who were on long academic leave or unwilling to participate were excluded.

Data Collection

Data collection was conducted from April to July 2025. 20 potential candidates were approached individually via text message about the study, and 10 of them agreed. Further arrangements for the data collection were subsequently made through text messages. Semi-structured, in-depth interviews were conducted in person in Malay or English, according to participants' preferences. Each interview lasted approximately 30-45 minutes and was audio recorded. Field notes capturing nonverbal cues and key observations were also maintained to support data

interpretation.

All interviews were conducted and transcribed by the second author, a final-year undergraduate student with prior training in qualitative research. She was familiar with the setting and participants, which facilitated rapport during interviews. The first and third authors jointly reviewed each interview recording and transcript to ensure accuracy and completeness of the collected data. All authors are fluent in both Malay and English, and they participated in the discussion to identify emerging codes and themes and to deepen analysis.

An interview guide was prepared and reviewed by two nursing education experts to ensure the questions were clear, relevant, and aligned with the study objectives. It was also pilot tested with two nursing students to ensure its validity. The interviews focused on participants' understandings of reflective practice, their experiences, perceived benefits and barriers, and suggestions for improving reflective practice. The objectives of the study and interview process were described before each interview.

Data collection was completed when data saturation was achieved with the tenth participant, as no new information or themes emerged. This indicates that the findings were both comprehensive and representative of diverse students' experiences²¹.

Data Analysis

The data were analyzed using Braun and Clarke's six-step thematic analysis method²². The analysis was carried out iteratively alongside data collection that deepened understanding of the data as the study progressed.

The first phase involved becoming acquainted with the data by regularly listening to the audio recordings and reading the verbatim transcriptions, which offered a thorough knowledge of the participants' narratives. The second phase was hand coding using Microsoft Excel, which was chosen for its accessibility and convenience of use over other software, including NVivo. Important words, essential phrases, and significant statements were highlighted and color-coded on the page, categorized by the second author and reviewed by other authors to ensure reliability. The third phase involved carefully examining and grouping the codes to detect trends, which led to the formulation of probable themes and subthemes across the interviews. These emerging themes were subsequently reviewed and modified via discussions with all authors in phase four.

The fifth step involved identifying and labelling the final themes, which were reinforced with sample extracts from participants' own words, and discussed among all authors. Finally, these themes were combined into a comprehensive written report that summarized and evaluated the data, offering valuable insights into nursing students' experiences and perspectives on reflective practice. For some selected participants' quotes originally in Malay, the research team, who are fluent in both languages, translated

them into English.

Trustworthiness

This study established trustworthiness by examining credibility, dependability, confirmability, and transferability. Credibility was established through weekly debriefing sessions with the research team, including experts in qualitative research and nursing education, to critically review emerging themes, coding, and interpretations, help to challenge assumptions, refine findings, and minimize bias.

Dependability and confirmability were supported through a clear audit trail, including field notes and coding memos documenting methodological decisions, coding phases, and theme development. Reflexivity was also maintained throughout the study, as the researcher continuously reflected on personal preconceptions and potential biases.

Transferability was addressed through purposive sampling and clear descriptions of the study setting and participants. Nursing students from Years 2 to 4 were selected to capture diverse perspectives and experiences of reflective practice. This variation enabled insights from both students with early exposure to reflection and those with more advanced clinical experience.

Ethical Consideration

This study obtained approval from the university's ethical committee (IREC (UG) 2025-021). The participants were presented with an information sheet detailing the study objectives, procedures, potential risks, and their rights as participants, including the voluntary nature of participation and the ability to withdraw at any time without penalty. Written informed consent was obtained before each interview. To protect confidentiality and anonymity, all identifying information was removed during transcription. Each participant was assigned a code to replace personal identifiers in transcripts and reports. The anonymized data, including transcripts and field notes, were securely stored on the password-protected devices accessible only to the researchers.

RESULTS

This study included a total of ten nursing students. Four of these were from Year 4, three from Year 3, and three from Year 2. **Table I** presents the demographic profiles of the participants by study year. All of the participants are Malay with an age range of 20-23 years old.

Overall, two main themes and six subthemes were identified from the analysis, as illustrated in **Table II**. These themes reflect students' engagement with reflective practice and their perceptions of its benefit in professional development.

Students' Engagement with Reflective Practice

This theme highlights that although participants recognized reflection as essential for professional development and utilized various reflective methods, they encountered barriers that limited their engagement.

Table I: Participants' demographic profile

Participants (P)	Year of study	Gender
1	3	Female
2	2	Female
3	4	Female
4	4	Female
5	3	Female
6	2	Female
7	2	Female
8	3	Female
9	4	Male
10	4	Male

Table II: Themes and subthemes

Themes	Subthemes
Students' engagement with reflective practice	Understanding of reflective practice
	Application of reflective practice
	Barriers to effective reflection
Reflective practice as a catalyst for professional development	Cultivating accountability through reflection
	Translating reflective practice into clinical competence
	Enhancing interpersonal skills and emotional resilience
	Strengthening critical thinking and ethical decision-making

Understanding of Reflective Practice

In the interview, most participants demonstrated basic awareness and conceptual understanding of reflective practice. Participants viewed it as a useful tool for self-evaluation and professional development, as shown in the following excerpt by P4.

"Yes, I'm familiar with reflective practice. It is the process of thinking critically about past actions, experience and decisions. It helped me become more self-aware and mindful throughout my nursing education and clinical practice." (P4, Year 4)

This suggests that some participants perceived reflection as more than an academic responsibility and valued its role in fostering professional behavior and clinical awareness.

Moreover, the following excerpt by P6 highlighted that reflection is both corrective and affirming.

"Reflective practice is like a method where we critically think about our experience... not only to identify mistakes but also to recognize good practice and reinforce it in the future." (P6, Year 2)

Similarly, P9 stated that reflection goes beyond recollection in the following excerpt.

"Reflective practice is when we think back on something that happened... It's more than just remembering. It's like critically analyzing our own experiences." (P9, Year 4)

Overall, these findings indicated that participants perceived reflective practice as a systematic, analytical process that enhances self-awareness and promotes high-quality patient care.

Application of Reflective Practice

It was found that the application of reflective practice varies from informal, conversational recall to more systematic and critical analysis of personal actions. For some, reflections were verbal and descriptive, as described by P5 in the following excerpt.

"I did reflections with my friends, but just an oral reflection. Not written. For example, reflecting on what you have done, what you have learned. Discuss together, ask opinions, exchange views." (P5, Year 3)

Others combined verbal reflection with reflective writing, as highlighted by P7.

"In classes during Year 1, there were also times we did verbal reflection. But most often, we did reflective writing. It was for us to improve." (P7, Year 2)

Some participants interacted more with organized models such as reflection-on-action, which became the most commonly used form, as expressed by P10.

"I think I mostly use reflection-on-action, because I usually reflect after coming back from the ward." (P10, Year 4)

Across these approaches, self-questioning emerged as a hallmark of deeper reflection, prompting participants to analyze their actions critically, the influencing factors, and their impact on themselves and others, as evident in the following excerpt from P7.

"During posting, we think back, like when we're in the ward, and we do something we're not satisfied with. Then afterwards, we think about it again. Why did I make that mistake? What influenced me to do that? What impact did it have on others, and on myself?" (P7, Year 2)

The findings demonstrated that while some participants preferred conversational reflections to share experiences and exchange views, others preferred written reflections to foster personal growth and enhance program quality. Reflection-on-action was typically carried out after clinical activities to evaluate performance. Self-questioning emerged as a central element, enabling participants to analyze their actions critically.

Barriers to Effective Reflection

Participants identified multiple factors that hindered their engagement with reflective practice. As reflected by P3 and P10, time constraints and fatigue emerged as the most common challenges. The demanding schedule of clinical placement often left participants with limited energy and motivation to engage in meaningful reflection.

"The most challenging, obviously, is self-writing...usually we do the self-reflective writing outside our posting time, so I prefer spending my free time sleeping, and I don't like it when I need to do work." (P3, Year 4)

"Honestly, it's about time. After coming back from

posting, I'm so tired that sometimes I only write a line or two for the reflection. Sometimes it doesn't even cross my mind to think about reflecting." (P10, Year 4)

Both of the participants also highlighted the difficulty of allocating time for reflection outside clinical hours. P10 and P9 further highlighted that uncertainty about how to begin or structure their reflections was also a barrier.

"Sometimes I don't even know where to start... there's so much to write in essay form. Sometimes I feel confused about how to do it." (P10, Year 4)

"Maybe lack of guidance. We're told to write reflections, but not always taught how to do them. So sometimes I'm not sure if I'm really reflecting or just writing." (P9, Year 4)

Emotional discomfort also emerged as a significant barrier. Some participants shared that reflecting on mistakes or negative experiences could trigger feelings of sadness and embarrassment. In the following excerpt, P7 highlighted the vulnerability involved in honest reflection of their mistakes.

"I'm afraid to face my mistakes. That's why... you know, when we reflect, we have to be honest with ourselves. Sometimes that makes me feel sad and embarrassed." (P7, Year 2)

Similarly, P5 described how distressing clinical experiences could make it difficult to engage in reflection.

"For me, emotional discomfort. If we have a bad experience in clinical, it disturbs our emotions, makes it hard to do reflection." (P5, Year 3)

Overall, the findings indicate that barriers to reflective practice were both practical and emotional, encompassing limited time, fatigue, uncertainty about reflective structure, and the emotional impact of confronting challenging clinical experience.

Reflective Practice as a Catalyst for Professional Development

In this theme, the participants expressed that reflective practice shapes their professional identity and readiness for clinical practice.

Cultivating Accountability through Reflection

Participants described how reflective practice fostered a stronger sense of professional accountability by shifting their focus from external factors to their own actions and decisions. P10 highlighted that this self-examination encouraged greater personal responsibility in clinical settings.

"It trained us to be accountable. We stopped just looking for others' faults and started examining our own first. Long term, it made us more careful and competent." (P10, Year 4)

For P7, taking ownership of mistakes instead of blaming others was seen as essential in preventing their recurrence.

"I noticed that people who aren't used to reflecting tend to repeat their mistakes... but if we learn to look at ourselves, it's not about blaming others... we blame ourselves. What did we do? Why did it happen that way?" (P7, Year 2)

Similarly, P4 emphasized that improvement depended on the willingness to accept constructive feedback, acknowledge their own shortcomings, and act upon them.

"There are people or lecturers who tell them what they've done wrong, but instead of reflecting on their mistakes, they blame the lecturer for being too harsh... if we're different, we take things, but they reject them."

Collectively, these findings demonstrate that reflective practice encouraged participants to take ownership of their decisions and actions and be receptive to constructive feedback.

Translating Reflective Practice into Clinical Competence

Participants reported that reflective practice enhanced their clinical competence by critically reviewing their performance, refining techniques and adopting safer practices. For example, P10 described how analyzing her previous approach led to improved procedural habits.

"So next time, I improved my technique. Slowly, it became a habit. Once the habit is corrected, I can avoid breaking sterility." (P10, Year 4)

Moreover, P9 reported increased attention to detail and better preparation before the procedure with reflection.

"It definitely made me more careful. Now, before any procedure, I double-check everything with the staff nurse. I plan my steps carefully." (P9, Year 4)

A particularly prominent area of improvement that participants highlighted was medication safety. P6 reflected on an incident in which the lecturer questioned her verification process, prompting her to re-evaluate and strengthen her practice.

"So, the lecturer asked me, and in the future, I can double-check the verification properly. That way, I won't make mistakes with patients, especially since medication can be critical." (P6, Year 2)

This heightened awareness was echoed by P9, whose earlier experience of miscalculating a medication dosage during Year 1 pharmacology class.

"In pharmacology, I got the drug calculation wrong during class... so after that, I trained myself to slow down and underline important values. It really improved my calculation skills." (P9, Year 4)

From the findings, reflective practice enabled participants to improve procedural skills, enhance preparation, and adopt safer practices. By critically reviewing their actions, they developed lasting habits such as careful planning, double-checking procedures, and refining techniques to avoid errors.

Enhancing Interpersonal Skills and Emotional Resilience

Participants described reflective practice as a means of improving communication, fostering better interpersonal interactions and managing emotional challenges, especially in clinical settings. For many, including P7, the process increased self-awareness of their communication style.

"I've become more aware of my weaknesses. I'm someone who finds it hard to communicate. But after reflecting, I understood that those feelings came from a lack of confidence." (P7, Year 2)

P6, in her excerpt, described how reflection prompted her to modify her approach when speaking with patients.

"I used to struggle with communicating with patients... But through reflection, I realized I needed to slow down, use clear language, and apply non-verbal communication." (P6, Year 2)

Reflection also deepened emotional intelligence, particularly in developing empathy. As P8 explained, this helped them manage emotions more effectively during patient care.

"When it comes to patients, we shouldn't be sympathetic; we have to be empathetic. That way, we can balance our emotions and do the work more effectively." (P8, Year 3)

The benefits of reflection extended to peer relationships. Group reflections not only supported learning but also fostered close connections, as P2 expressed in the following excerpt.

"That thing also brings me closer to my relationships with my friends because we all reflect together about the patients that we take care of." (P2, Year 2)

Beyond interpersonal gains, participants reported that reflective practice contributed to emotional resilience. For some, including P9 and P6, it provided a constructive outlet to process difficult experiences.

"If I don't reflect, the problems will just get worse. By reflecting, I process my feelings and learn coping mechanisms. In clinical settings, it helps improve my skills and interactions with patients... especially in communication." (P9, Year 4)

Similarly, P6 highlighted that reflection enabled her to reframe and learn from challenging times to improve in the future.

"Emotionally, it helps to reduce my stress... It gives me space to process difficult experiences. I can be better next time. I don't feel guilty or feel like I'm not improving."

P4 summarized the multidimensional values of reflective practice in the following excerpt.

"Reflective practice helps me manage my emotional stress, strengthen clinical reasoning, promote professional and personal growth, and improve the quality of care."

Overall, these findings show that reflective practice not only enhanced participants' ability to communicate clearly and empathetically but also fostered stronger professional relationships and improved emotional resilience.

Strengthening Critical Thinking and Ethical Decision-making

Participants consistently reported that reflection improved their ability to think critically and make sound, ethically grounded decisions in clinical settings. P3 admitted that revisiting past experiences led her to develop a habit of analyzing consequences

and seeking safer or more effective alternatives.

"At first, I didn't even see how we use critical thinking. But now in my final year, I know... especially in the ED setting... if we do this, what will happen? Reflecting shows the impact of every action" (P3, Year 4)

For P10, reflection became a safeguard against unquestioning compliance, prompting her to weigh options carefully with patient safety as the primary concern.

"Now I reflect and ask myself, why do it this way? Is there a better way? I think more about the patient's safety, not just follow what others say blindly." (P10, Year 4)

Several participants shared that reflection also improved their ability to make better decisions. P6 noted how reflection guided her to identify the root cause of errors and adjust her approach accordingly.

"In clinical practice, it sharpens my decision-making and critical thinking. I analyze what went wrong and what I should do differently next time." (P6, Year 2)

In critical situations, participants discovered that reflective practice increased decision-making speed, integrity, confidence and clarity in action. For example, P1 and P2 in the following excerpts described how their earlier reflections prepared them for high-pressure decision-making.

"When the patient can't breathe, we must act fast. Because we already reflected before, we know what to do and make decisions without any doubt." (P1, Year 4)

"When I always reflect, and problems arise, I can think faster and make decisions more quickly. It improves my thinking and decision-making skills." (P2, Year 2)

Similarly, P7 emphasized that reflective practice also discouraged emotional or impulsive behaviour by fostering empathy and ethical reasoning.

"Reflective practice helps me think deeply and not decide based on emotion. I now consider the patient's perspective and ask... what's the best option?" (P7, Year 2)

In sum, participants viewed reflection as an essential discipline that integrated critical analysis, ethical reasoning, and situational awareness to deliver safe, patient-centered and ethically sound care.

DISCUSSION

Students' Engagement with Reflective Practice

The findings showed that students generally understood reflection as important for personal and professional development, not merely an academic requirement. This is consistent with a previous study showing that nurses who engaged in reflective activities had greater self-efficacy and work engagement, suggesting that early exposure to reflective thinking supports long-term professional growth²³. It also reflects Schön's view that reflective practitioners are driven not only by formal evaluation, but also by an intrinsic desire for self-improvement²⁴. This study also found that students associate reflection with mindfulness and ethical awareness in

clinical care, consistent with a previous study²⁵. With effective guidance, novice learners can progress from passive recognition to intentional reflection, strengthening clinical reasoning²⁶. This supports structured reflective teaching models that move learners from descriptive accounts to analytical reasoning¹⁵. Structured tools and guiding questions also found deepen reflection by linking knowledge with action²⁷.

Students in this study engaged with reflection through diverse methods, from informal peer discussions to structured models such as reflection-on-action. Informal verbal reflections encouraged real-time learning, while reflective writing enabled deeper introspection²⁸. Reflection-on-action allowed students to analyze decision-making after clinical encounters²⁹. Across all methods, self-questioning emerged as pivotal in this study, which potentially transform descriptive recollection into critical examination³⁰.

Despite their awareness, students faced barriers such as time constraints, fatigue, lack of guidance, and emotional discomfort. These challenges mirror earlier reports that academic overload limits reflective engagement and that insufficient structural support leads to superficial reflection³¹. Emotional discomfort was a recurring obstacle, as honest self-appraisal can provoke vulnerability and distress³². Without mentorship and safe environments, reflection risks becoming performative rather than transformative¹⁵.

Reflective Practice as a Catalyst for Excellence and Professional Development

Students described reflective practice as vital in cultivating accountability and enhancing clinical competence. By critically analyzing their actions, they developed a stronger sense of professional responsibility and openness to feedback, consistent with previous studies^{33,34}. Reflection shifted their focus from externalizing blame to recognizing their personal contributions to outcomes.

Through continuous reflection, students refined their procedural accuracy and adherence to safety standards. This finding echoes other studies that noted that reflection enhances precision, self-correction, and the integration of theoretical knowledge into safe practice^{35,36}.

Reflective practice was also found to strengthen students' communication skills and emotional resilience. Reflection increased their awareness of personal communication barriers and encouraged the use of clearer, more empathetic approaches^{23,37}. Group reflections further promoted collaboration, shared understanding, and mutual support among students in this study, fostering a sense of belonging and collective learning³⁸.

Emotionally, reflection provided a healthy outlet for processing challenging clinical experiences. Students reported that revisiting stressful events helped them manage guilt, frustration, and self-doubt while developing empathy and composure. This aligns with a previous study that found that reflection nurtures

emotional intelligence and resilience, the qualities essential for compassionate and sustainable nursing practice³⁹.

Reflection was also perceived as further enhancing critical thinking and ethical judgment. By analyzing past experiences, students learned to evaluate consequences, question assumptions, and make safer, evidence-based decisions, as also highlighted by previous studies^{40,41}. Students in this study also noted that prior reflective experiences improved their readiness during emergencies, leading to faster, more confident responses. This supports a previous study⁴², which reported that structured debriefings improve judgment and communication.

From a nursing education standpoint, these findings emphasize the need to embed guided reflective practice as a core component of the nursing curriculum. Nurse educators should be trained to model reflective thinking and provide constructive feedback, helping students internalize reflection as a habit.

This study was limited by its small single-site sample, which may restrict the generalizability of the findings. The reliance on self-reported data could introduce recall or social desirability bias. There was also potential selection bias, as participants were deliberately selected. Despite these limitations, the findings provide valuable insights into nursing students' reflective practices within their educational context.

CONCLUSION

This study revealed that reflective practice plays a crucial role in shaping nursing students' excellence and professional growth. Students viewed reflection as a transformative process that fosters accountability, clinical competence, emotional resilience, and ethical decision-making. However, engagement was often constrained by limited time, lack of guidance, and emotional discomfort. For nursing education and practice, this study highlights the importance of training educators and preceptors to model reflective behaviors and guide meaningful reflection.

Future studies could expand this work by including participants from multiple institutions, examining educators' perspectives on facilitating reflection and exploring the use of digital tools to support reflection in an increasingly technology-driven learning environment.

Acknowledgement

We want to thank all the students who participated in this study.

Ethical permission: International Islamic University, Bandar Indera Mahkota, Kuantan, Pahang, Malaysia, ERC approval letter No. IREC (UG) 2025-021.

Conflict of interest: Authors declare no competing interests in the study.

Financial Disclosure / Grant Approval: This study had no external funding.

Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Atan A: Collected data and wrote the research report
Ramli NQ: Collected data and wrote the research report

Pairon H: Verified the findings

Azmi B: Verified the findings

All authors developed the idea and carried out the research and reviewed the results and made contributions to the final manuscript.

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