

Reflective Audio Note (RAN): A novel tool for enhancing reflection in pharmacy education – A case study report

Mirey Alfarah¹, Lone Holst¹, Aase Raddum²

¹Centre for Pharmacy, Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway

²Centre for Pharmacy, Department of Clinical Science University of Bergen, Bergen, Norway

Abstract

Background: Reflection is an essential skill for pharmacists. Teaching reflection and fostering a meaningful reflective practice remains challenging in health education. Traditional written reflections are often perceived as time consuming and disconnected from learning. To address this, we designed and implemented the Reflective Audio Notes (RAN), a low-threshold, mobile based reflective assignment. RAN aimed to enhance immediacy, authenticity, and inclusivity in reflection across diverse pharmacy learning contexts.

Case Description: RAN was implemented in three courses at the University of Bergen's integrated Master of Pharmacy program. Students recorded short reflections during or after placement and lab experiential activities. Educators provided formative feedback through either individual audio responses or group discussions. Data were collected through pre/post surveys and focus groups over two years (2021–2023).

Case Themes: Students described the RAN as a positive, engaging, and a time-efficient way to reflect. Speaking aloud felt more natural and personal than writing, helping them express emotions honestly. It deepened their understanding and helped them connect experiences to their future pharmacist roles. This format also reduced language barriers, allowing students with varying writing confidence to participate equally. When teachers responded, students felt heard and educators gained clearer insight into students' feelings.

Impact: RAN improved student engagement, metacognition, and professional identity formation. For educators, it provided real-time insights into student learning and prompted interdisciplinary collaboration. Institutionally, RAN fostered a culture of inclusive, experiential learning and inspired broader application across health education. RAN demonstrates that effective reflective learning can be achieved through flexible, and human-centred pedagogical design

Keywords: audio reflective assignment, pharmacy education, teaching reflection, active learning, audio feedback, health education, experiential learning, flexible teaching

Background

Reflection is increasingly recognized as a core element of professional development in pharmacy education. It supports critical thinking, clinical reasoning, and the formation of professional identity¹. As pharmacy practice evolves from product-oriented tasks toward patient-centred care, the ability to engage in reflective practice becomes essential for navigating complexity and uncertainty in clinical encounters².

Bridging the gap between classroom theory and clinical practice remains a persistent challenge in pharmacy education. Despite curricular efforts, many students struggle to apply foundational knowledge in real-world contexts. Studies on pharmacy students' critical-thinking skills suggest some development over time, particularly in analysis and evaluation, but point to stagnation in students' motivation to think critically and reflectively³.

Corresponding Author:

Mirey Alfarah
Centre for Pharmacy, Department of Global Public Health and Primary Care
University of Bergen
Bergen, Norway
+47 55586198
mirey.alfarah@uib.no

A growing body of research supports the integration of structured reflection into pharmacy curricula. Approaches such as written reflective assignments, video-based analysis, and simulated patient cases have been shown to foster metacognition, self-assessment, and professional growth⁴. Drawing on Donald Schön's concepts of reflection-in-action and reflection-on-action, educators have sought tools that encourage both real-time sensemaking and retrospective learning from experience⁵.

Kolb's Experiential Learning Theory (ELT) provides a robust theoretical foundation for designing reflective learning activities. In ELT, learning is conceived as a cycle beginning with concrete experience, followed by reflective observation, abstract conceptualization, and active experimentation⁶.

Reflection thus functions as a bridge between doing and learning, enabling students to transform experience into professional insight.

However, reflective assignments in pharmacy education, especially in placements, tend to rely on written formats, which can be perceived as burdensome and disconnected from the learning moment. Students often report uncertainty about what to reflect on, while educators find written submissions superficial or formulaic⁷. Reflection remains a complex skill to teach and sustain in healthcare education, requiring continuous external input and supportive pedagogical structures⁷. Traditional strategies, such as written portfolios, vignettes, and self-report logs, are often perceived as rigid or disconnected from authentic learning experiences, limiting students' curiosity and engagement⁸. Recent reviews have emphasized that effective reflective practice depends on clear purpose, flexible structure, and active facilitation by educators⁹.

To address this gap, we designed and implemented Reflective Audio Notes (RAN), a mobile-based reflection tool enabling pharmacy students to record their reflections during or immediately after an experience. The activity is low-threshold both logistically and pedagogically: the mobile format makes it easily accessible in situ, and the open, low-stakes structure allows students to articulate reflections without concern for formality or performance. Expectations are clarified and trialed before placement (See section 2.2). The aim was to enhance the authenticity, engagement, and pedagogical value of reflective practice across diverse learning contexts.

Theoretical Framework: Experiential Learning and Reflection

Reflective Audio Notes (RAN) were conceptually grounded in Kolb's ELT, which views learning as a cyclical process⁶. ELT builds on Dewey, Lewin, and Piaget, with learning emerging through the transformation of concrete experience into abstract understanding, then re-applied in new contexts¹⁰⁻¹².

In pharmacy education, ELT is especially relevant as placements, lab work, and patient-facing activities provide rich experiential material. However, without structured reflection, these experiences risk remaining unexamined. Kolb's model highlights reflective observation as a critical phase, enabling students to process events, identify learning moments, and construct meaning⁶.

RAN targets this phase explicitly. By prompting students to record their reflections in real time, the tool supports:

- Reflection-in-action, where learners make sense of experiences as they occur¹³.
- Reflection-on-action, where learners revisit and evaluate past experiences, forming insights for future practice¹³.

The RAN design also draws on Boud's perspective that reflection must be responsive to context, flexible, situated, and meaningful to the learner¹⁴. Rather than imposing standardized written formats, audio notes allow students to reflect more naturally, in their own words and timing, increasing authenticity and engagement.

By aligning with ELT and situated learning principles, RAN enables reflection as an embedded, active learning strategy, supporting deeper learning, professional identity formation, and learner agency in pharmacy education¹⁵.

DESCRIPTION OF THE CASE

Context and Rationale for the Innovation

Reflective assignments have long been part of pharmacy education, particularly in placement-based learning. However, in the recent years, both students and faculty at the University of Bergen reported dissatisfaction with traditional written reflections: students found them time-consuming and vague in expectations; educators found them superficial and unengaging. Additionally, the arrival of AI tools has made it challenging for the educators to separate individually student written reflection notes and an AI-generated text. Another reason is to help students practice oral communication that is a key skill for future pharmacists. In response, we developed Reflective Audio Notes (RAN) a mobile-based, low-tech tool designed to facilitate more immediate, authentic, and accessible reflection during experiential learning.

RAN was piloted within three courses of an integrated Master of Pharmacy programme:

- Social Pharmacy (1st year)
- Clinical Pharmacy (4th year)
- Pharmaceutics Laboratory Course (4th year)

This section details the design, implementation, and adaptation of RAN across these distinct learning environments.

The project was assessed by an administrator at the Regional Committees for Medical and Health Research Ethics Western Norway (REK Vest), who determined that the study does not fall within the scope of the Norwegian Health Research Act and therefore did not require formal ethical approval. All participants received written and oral information about the study and provided informed consent prior to participation. Data were processed confidentially and in accordance with institutional data protection requirements at the University of Bergen, and the project was registered in the RETTE system.

Clinical and social pharmacy placement experiential learning

Including reflective practices after placements is ubiquitous in healthcare and pharmacy education¹⁶. The intention of including reflective practices in relation to placements can be varied, and include professional identity formation, identifying current and future learning outcomes as well as adding value

to the experiential learning that comes from situations experienced during the placement⁶. Reflection has been an integrated part of placements and assessment in the clinical pharmacy and social pharmacy courses at the University of Bergen. For the Social Pharmacy Course, students are in the first semester of the first year and they get to spend four days in a pharmacy. During this short placement period, first year students are expected to observe and get acquainted with the pharmacy setting. The RAN was used for the post placement reflection assignment. In the clinical pharmacy course, the students are in their 4th year. The placements are focused on patient-related pharmacist tasks and interprofessional collaboration, and situated in hospital ward, care home or home-based care. For several years, a mandatory part of the portfolio-based assessment of the course has been a written reflective essay. In the fall of 2021, the RAN was used for the first time for the reflection assignment. Specifically, the students were asked to compile a total of three RANs corresponding to the different settings where the placement was situated: 1) Care home and home-based care, 2) Hospital ward, 3) Interprofessional placement with other healthcare students in primary care. In both courses, prior to the placements, an introductory session was conducted, where the concept of the RAN was explained to the students, including the value of reflection and metacognition, theory on reflective practice and experiential learning, as well as practical information on how the RAN was going to be recorded using their phones and the file uploaded to the learning management system Canvas. Students were then required to do a test RAN to uncover any insecurities or technical issues before the start of the placement. The structure of the introductory session is summarized in Figure 1. Individual feedback on the RAN from the teacher was provided focusing on both the reflection itself and on each student's concrete learning experience. The feedback was delivered in the same format, as an individual audio note recorded for each student and uploaded to the learning management system Canvas.

Pharmaceutics - Laboratory course

The use of RAN was applied in a one-week laboratory course on compounding of non-sterile dosage forms. Through feedback and previous years evaluations, the students reported that they dreaded this specific lab course and entered the laboratory feeling apprehensive. From the educators' perspective, this was apparent, as the students often expressed insecurity when performing the experimental tasks of the course and needed a lot of reassurance and support. Ultimately, this resulted in an unfavourable learning environment dominated by a fear of failing¹⁷. To remedy this trend, the use of the RAN was implemented. Reflection had previously not been a part of the lab course in any form, rendering not only the audio format of the RAN as new, but also the application of reflection in the laboratory context. In this setting, the aim was thus to enhance student agency and confidence¹⁸. By using reflection in the laboratory, the

students could specify their own learning experience and become aware of their learning outcomes in real time, much like a personal meta conversation. Specifically, the students were asked to record a total of seven RANs throughout the lab course related to the following instructions: 1- Expectations and preparedness for the upcoming lab course (recorded before the beginning of the course), 2- A new learning outcome and a negative and positive experience of the day in the lab (recorded at the end of each day, five RANs in total), 3- Reflections on learning outcome of the course as a whole (recorded after the completion of the course). The teachers listened and reviewed the RANs from the students at the end of each day of the course, resulting in a day-to-day overview and insight into the students' experiential learning. At the beginning of each day of the lab course, the teachers gave formative feedback, based on yesterday's student RANs, providing general commentaries and addressing concepts that appeared unclear to the students. In this way, the teachers demonstrated interest in the students learning experience and established a dialogue between student and teacher that persisted throughout the course.

An overview of the use of RANs in different settings is displayed in Figure 2. The activity was developed as a collaboration between educators and an educational developer, rendering the activity designed and adapted for specific needs in the respective courses, and informed and grounded in pedagogical theory.

The RAN was first tested out in the Clinical pharmacy course and Social pharmacy course of the fall semester 2021. The activity was continued in the Clinical pharmacy course in the fall semester of 2022, 2023 and 2024 but only in 2022 for the social pharmacy course. For the Pharmaceutics course, the RAN was first tested in the fall semester of 2022 and continued in 2023 and 2024. The number of students in each course varied between 17 and 27. The activity is subjected to constant development and evaluation, and the RAN is developed according to feedback from the students. The main assessment of the activity, for research purposes, was done in 2021 and 2022, by a mixed-methods approach, including pre- and post-surveys and focus group interviews. The research team consisted of three educators (LH, RLSK, AMR) and one educational developer (MA). The focus group interviews were conducted by the educational developer. Students in the participating years were provided written and oral information about the study and signed an informed consent form before participating in the study. Data was treated anonymously and confidentially, and participants could withdraw from the study without consequences. The university data protection officer ensured that considerations on data protection was sufficient, and the project was registered in the University of Bergen system for risk and compliance (RETTE). A total of four focus groups were performed: two focus groups from the 2021 Clinical pharmacy students and two focus groups from the 2022 Clinical pharmacy students (n=7 and n=9). Invitation to

participate in the focus groups was sent via e-mail to each cohort. All focus groups were done at the end of the semester after course completion and lasted between 45 and 60 minutes.

Case Analysis

To deepen our understanding of students' experiences with the Reflective Audio Note (RAN), we conducted a series of focus groups. Consistent with the questionnaire findings, students generally expressed positive views of RAN as a tool for reflection. The focus groups were designed to evaluate a broader set of active learning strategies introduced through the FREMFARM project, with RAN representing one component. An inductive thematic analysis was conducted¹⁹ and in this section, we present only the findings related to RAN. Focus groups interviews were conducted in Norwegian and English, transcribed verbatim, and when necessary, translated into English by MA, ensuring conceptual and contextual accuracy²⁰.

Students' perspective

After placement we run the Reflective Practice Questionnaire (adapted from Rogers SL) application for medical education, see appendix for a copy of used questionnaire^{21,22}. We analysed the open questions related to the use of the RAN using a simple thematic approach. The questionnaire was run through Mentimeter, and we focus here only on the open-ended questions related to the use and implementation of the RAN. For the closed question on preferred method, descriptive counts were used. For the open-ended questions, all responses were reviewed and grouped into recurring themes, which are summarised below and supported with direct student quotes.

Preferred method and reasons

When asked about their preferences, Reflective Audio Note (RAN), written reflective essay, or a combination of both, the majority preferred RAN over the written assignment. These results were consistent across all cohorts (see example Figure 3).

In the open question "Can you explain why?" () that followed the initial question "select the method that suits you best to share your reflections during/after placement", students generally described RAN as a positive and useful experience. They emphasised practicality: "Overall good! It was more time-efficient than writing" and "quick and simple." Some found it enjoyable and motivating: "It was fun, new, and easy to use," and "brilliant, more practical and personal." Others highlighted that audio allowed for more authentic expression: "I think the reflection would have been less honest and more formal if it had been written" and "I felt it was easier to reflect verbally than to write it down."

Several also valued the spontaneity of speaking, saying it was "easier to be spontaneous" and "easier to just say what you

think." Others highlighted that audio reflections still supported meaningful reflection, describing the method as "an efficient way to work, but still allowed me to reflect well." Others highlighted the personal dimension: "Recording was simple and quick, and I felt more personal, speaking freely and openly about practice."

Challenges experienced.

In the open question "What challenges did you face when using the reflection audio note?" students reported three main types of challenges, mainly in relation to structure and expression. Students mentioned that it was challenging to structure their thoughts and recorded it verbally "difficult to keep a logical sequence" or "hard to formulate clearly when speaking spontaneously," sometimes leading to multiple recordings: "I had to record it many times to get a clear version." Time was also a recurring issue, with some finding it "difficult to control the time" and others frustrated that "you can't say everything you want in just a few minutes."

It was also expressed by some students the discomfort with hearing one's own voice: "It was awkward to hear my own voice" and "strange at first, but easier after a while." Some noted that the format felt unfamiliar and required practice: "Everything was new, how should you communicate?" A few said they preferred dialogue over solo recording: "I got much more out of talking with fellow students than from recording an audio note." Others mentioned that they ended up repeating themselves, producing "superficial reflections" or struggling with spontaneity: "I felt I said more or less the same in all audio notes."

Linking reflection to future practice.

Students often connected the RAN to a situation they expected to face in the future as pharmacists. For some, the exercise highlighted the importance of structured communications and reflected on language barriers and on the importance of being able to explain about medication or even when collaborating with other health professionals. One student emphasized that RAN gave practice in concise and concrete arguments because of the short length of the requested RAN (FG2_2021_P3). Others reflected on the broader role of the pharmacist, noting that the process encouraged them to think about responsibilities beyond dispensing, such as asking critical questions and ensuring appropriate patient care. In one of the focus groups, a student described a rough day during a practice experience in a hospital ward. The experience encompassed an unpleasant experience in an encounter with a healthcare professional colleague. This encounter made the student doubt on their choice of becoming a pharmacist, however, when the student worked on the RAN, they connected the dots on the whole experience and made them conclude that pharmacists are an important part of the healthcare system... "...I have reinforced that feeling that we can also do something, especially after being in the hospital with the clinical pharmacist ... it is not

only about delivering the medicine, but also about asking questions, checking if something is wrong, maybe the patient needs something else ... to do more of that.” (FG2_2021_P2).

Relational aspects and feedback.

The value of RAN was amplified when accompanied by teacher engagement. Students emphasized that receiving audio feedback created a genuine sense of being listened to and supported, which in turn increased their motivation to reflect. For many, this interaction differentiated RAN from being “just another assignment” and transformed it into a dialogic, relational tool that strengthened the connection between students and educators. As one student noted, “I felt the teachers actually listened and followed up, and that made it meaningful” (FG4_2022_P2).

Moreover, listening to students’ voices rather than reading their texts revealed emotional dimensions often absent from written reflections. This auditory format allowed educators to perceive tone, hesitation, and affect, removing a “filter” that typically obscures students’ feelings in scientific subjects. One student captured this sentiment: “It was good that they heard not only what we said, but also how we felt” (FG3_2022_P1).

Accessibility and inclusion.

Students consistently described RAN as a more accessible and less intimidating reflective method than traditional writing tasks. This was particularly evident among students who expressed limited confidence in written Norwegian or English. For these students, the ability to record thoughts verbally removed a linguistic barrier and enabled them to communicate ideas more naturally. The focus shifted from grammatical accuracy and structure toward conveying meaning and personal insight, allowing them to engage with the reflective task on equal footing with peers.

Several students commented that the audio format provided a “freer space to think,” in which they could express ideas as they emerged rather than editing or translating them mentally before writing. This immediacy fostered a sense of authenticity and ownership over the reflective process. One student described it as “easier to speak my thoughts than to find the right words in writing.”

The accessibility of RAN also extended beyond language. Students who reported difficulties organizing written reflections found that speaking aloud helped clarify their thinking. The low-threshold, mobile-based format, recording on a personal device in a familiar environment, lowered the psychological barriers associated with formal reflective writing and encouraged wider participation.

Faculty perspective

Structured feedback from the faculty was not collected, due to the number of persons involved being low. Instead, the faculty that had used the RAN gave feedback through an open,

unstructured discussion with the educational developer. The experience of using the RAN from the educators’ perspective was mostly positive. The educators agreed that listening to the RANs provided them with a more nuanced and honest insight into students’ learning experiences, compared to written reflective assignments. On the other hand, discrepancies regarding workload surfaced when it came to provision of feedback. For the placement setting, the educators recorded individual feedback to each student, which some teachers found burdensome and a higher workload than providing feedback in writing. To first listen to a student RAN, in some cases, several RANs from the same student, and then record an audio note with specific feedback to each student afterwards is more time-consuming than reading a text and providing formative written comments. Nevertheless, this came down to personal preference as some still prefer the written format whereas others prefer the oral format. The faculty agreed that providing the students with options in terms of written or oral format to cater for different student preferences can enhance student engagement in reflective practices.

Regarding the laboratory setting, the use of feedback after the RAN was slightly different, as feedback was only given to the students in a group setting, and solely in real-time, not recorded. Despite reflection not being included in the laboratory course in the past, thus meaning that the RAN was an addition to the course, the educators involved all found it valuable. The educators described the RAN activity as an observation of student learning in real-time which provided insight into processes and an opportunity to gain overview of learning outcomes as they occurred. The workload in this case consisted of listening to the RANs in the afternoon after the lab was finished, or in the morning before the start of the next day of the course, which concretely took approximately 60 minutes in our case. The first time the RAN was implemented in the laboratory course, the students recorded one RAN for each day of the course, but feedback from the faculty showed that this was excessive and time-consuming. For the next years, the number of RANs were reduced to decrease workload. The latter can also demonstrate the flexibility of the RAN activity, as it can continuously develop and get adapted to various needs from both faculty and students.

Identification Of Case Themes

Analysis of student and faculty data across the three courses revealed a coherent set of themes characterizing the pedagogical value, challenges, and broader implications of the RAN. These themes represent interpretive categories derived from triangulation of questionnaire responses, focus group discussions, and educators feedback.

Spontaneous reflection

RAN facilitated spontaneous reflection “in the moment,” capturing thoughts and emotions before they were filtered through the conventions of academic writing. Students

described being “more honest,” “less formal,” and “able to say what they really thought.” This immediacy aligns with Schön’s concept of reflection-in-action, supporting deeper sense-making while experiences were still fresh⁵.

Affective dimensions of learning

Listening to the recordings also revealed affective dimensions of learning; tone, hesitation, and enthusiasm, that are often invisible in written work. Educators noted that this emotional transparency helped them better understand students’ engagement and struggles.

Structured reflection

When linked to Kolb’s Experiential Learning Cycle, RAN prompted students to move beyond description toward interpretation and planning⁶. The concise, structured, practice-oriented prompts anchored reflections in concrete experiences and gave direction to otherwise open-ended reflection. This structure allowed even novice reflectors to produce meaningful insights and to connect learning experiences across settings.

Reduced barriers

The oral format reduced linguistic and cognitive barriers, enabling participation from students who were less confident in written Norwegian or English, or who simply think better aloud. By emphasizing meaning over form, RAN supported equitable engagement and allowed a broader range of students to demonstrate reflective competence. Educators observed that RAN thus functioned as an inclusive practice, accommodating diverse communication preferences and promoting a sense of belonging within the learning community.

Feedback

The value of RAN increased when students perceived that educators actively listened and responded. Audio or real-time feedback created a sense of dialogue rather than unidirectional evaluation. Students described feeling “heard” and “taken seriously,” which in turn strengthened motivation to reflect. This relational dimension reframed reflection as a shared professional conversation rather than an individual writing task.

Reflection for professional identity development (PID)

Students often linked their RAN reflections to future practice, expressing greater awareness of their emerging professional role and social responsibility as pharmacists. Speaking about real encounters, both positive and challenging, helped them articulate values, empathy, and accountability. RAN thus supported not only cognitive but also moral and professional dimensions of learning, reinforcing reflection as a central mechanism in identity development.

Case Impact

The introduction of the RAN has reshaped both teaching and learning practices in the pharmacy program. Originally designed as a practical alternative to written reflections, RAN has evolved into a handy pedagogical tool that promotes authentic, accessible, and context-sensitive reflection across diverse learning environments.

Use of RAN in teaching

At the institutional level, RAN prompted new interdisciplinary collaboration among educators from different courses (social pharmacy, clinical pharmacy, and pharmaceuticals) who co-developed and refined the activity for their respective contexts. This process fostered dialogue across disciplinary boundaries and strengthened a shared pedagogical culture focused on experiential learning and inclusion.

For educators, RAN provided a new window into student learning as it unfolded. Listening to students’ reflections gave more immediate, nuanced insights than written submissions, allowing educators to respond to learning needs in real time. This shift from retrospective to ongoing feedback has enriched teaching practice and supported continuous course improvement. However, feedback delivery required adaptation: individual audio responses were time-consuming, while group feedback in the lab course proved efficient and sustainable. This flexibility suggests that RAN can be scaled or modified to suit context, class size, and instructional goals.

The recent introduction of AI in higher education has created both opportunities and challenges. In the context of written assignments, distinguishing between student-authored and AI-generated text can be difficult. Although RAN was not designed as a response to AI-related concerns, the use of audio reflections represents an assessment format that is more demanding to generate than text and may therefore introduce additional authenticity to reflective work.

In line with principles of good practice in Scholarship of Teaching and Learning (SoTL)²³, RAN has been disseminated across multiple contexts, including scientific conferences and informal exchanges with collaborators. We see clear value in establishing a community of practice among educators using RAN, to share experiences, explore new applications, and support the continued development of the activity.

Impact on students’ learning and development

For students, the audio format made reflection more natural and less constrained. Speaking aloud encouraged spontaneous, honest expression and reduced the pressure often associated with academic writing. The method was particularly appreciated by students with language barriers or those who prefer oral communication, making RAN a more inclusive approach to reflection. The use of concrete prompts and a clear theoretical framework (The Kolb Experiential Learning Cycle) helped students connect reflection to daily

experiences and recognize learning moments in a memorable way.

The RAN initiative has also influenced attitudes toward reflection itself. Students who previously viewed reflective assignments as formal or obligatory began to perceive reflection as a useful, even enjoyable, part of their professional growth. Educators, in turn, have started to explore how RAN might support professional identity formation and interprofessional learning.

Potential for RAN in other disciplines

Reflection is a well-established pedagogical practice in health professions and social science disciplines, including teacher education²⁴ as it supports metacognition, self-evaluation, critical thinking, problem-solving, decision-making, and professional judgement²⁵. These competencies underpin lifelong learning and, in health education, patient-centred practice. The challenges of facilitating meaningful reflection reported in these disciplines are comparable to those identified in pharmacy education. Therefore, we argue that the RAN has potential applicability beyond pharmacy. As a structured and flexible reflective tool, RAN can be implemented across disciplines and educational contexts, including both didactic and practice-based settings.

Future research - long term learning and retention

Future research should examine the long-term impact of RAN on students' learning beyond graduation, including whether graduates continue to apply reflective practices in their professional work. Specifically, this includes investigating whether the intervention contributes to the development of reflective practitioners. As some students indicated an intention to use RAN outside formal educational settings, further research is needed to assess the sustainability of RAN over time, including whether alumni continue to use it for self-assessment and reflection. Such studies should identify enablers and barriers to transferring reflection practices from education to professional practice, with particular attention to recently graduated pharmacists. Additionally, future research could explore whether sustained reflective practice is associated with professional resilience and reduced risk of burnout

Conclusion

RAN has proven to be a handy, flexible, inclusive, and sustainable tool that brings reflection closer to the lived experience of learning. It bridges theory and practice not only for students, but also among educators, turning reflection into a shared, evolving practice within pharmacy education.

RAN transforms reflection from a formal written exercise into an accessible, student-centred practice embedded in the flow of experiential learning. By allowing students to record their thoughts in real time and in their own words, RAN reduces

linguistic and structural barriers while preserving immediacy and authenticity.

Consistent with Boud's argument that reflection must be responsive to context and meaningful to the learner, RAN can be adapted across diverse educational settings, from placements to laboratories, without compromising its simplicity²⁶. Its flexibility also accommodates varying levels of reflective experience, supporting both novice and advanced learners.

Basically, RAN demonstrates that fostering reflective capacity and that it is a transferable and transdisciplinary tool that can be implemented not only in health education but also in other disciplines that rely on experiential learning. Its simplicity, flexibility, and emphasis on authenticity make it suitable for diverse educational contexts. However, RAN has not yet been tested in large cohorts, and further research is needed to evaluate its scalability, impact on learning outcomes, and long-term sustainability within different pedagogical and cultural settings.

Acknowledgments: The authors gratefully acknowledge the following individuals for their support during the design, implementation, and evaluation of the RAN: Reidun L.S. Kjome from the Centre for Pharmacy, University of Bergen, for her continuous support and feedback, particularly during the early stages of the FREMFARM project; and Quynh Bao Truong Le from the Centre for Pharmacy, University of Bergen, for her feedback and support in using the RAN in the Pharmaceutics course.

Funding/Support: This study is part of the FREMFARM project FREMFARM Funded by HK-dir Norwegian Directorate for Higher Education and Skills and the Norwegian Foundation for Pharmacy Practice Research.

Disclaimer: The statements, opinions, and data contained in all publications are those of the authors.

Declaration of Competing Interest: None

References

1. Artioli G, Deiana L, De Vincenzo F, et al. Health professionals and students' experiences of reflective writing in learning: A qualitative meta-synthesis. *BMC medical education*. 2021;21(1):394. doi:10.1186/s12909-021-02831-4
2. Luetsch K, Burrows J. From transitions to transformation—A study of pharmacists developing patient-centered communication skills. *Research in Social and Administrative Pharmacy*. 2018;14(7):686–694. doi:10.1016/j.sapharm.2017.08.003
3. Miller DR. Longitudinal assessment of critical thinking in pharmacy students. *American Journal of Pharmaceutical Education*. 2003;67(4):890.
4. Austin Z, Gregory PA, Chiu S. Use of reflection-in-action and self-assessment to promote critical thinking among pharmacy students. *American Journal of Pharmaceutical*

- Education. 2008;72(3):48. doi:10.1016/S0002-9459(24)00402-9
5. Schön D. From technical rationality to reflection-in-action. *Boundaries of adult learning*. Routledge; 2013:8–31.
 6. Kolb DA. *Experiential learning: Experience as the source of learning and development*. FT press; 2014.
 7. Mantzourani E, Desselle S, Le J, Lonie J, Lucas C. The role of reflective practice in healthcare professions: Next steps for pharmacy education and practice. *Research in Social and Administrative Pharmacy*. 2019;15(12):1476–1479. doi:<https://doi.org/10.1016/j.sapharm.2019.03.011>
 8. Koshy K, Limb C, Gundogan B, Whitehurst K, Jafree DJ. Reflective practice in health care and how to reflect effectively. *IJS Oncology*. 2017;2(6):e20. doi:10.1097/IJ9.0000000000000020
 9. Mann K, Gordon J, MacLeod A. Reflection and reflective practice in health professions education: a systematic review. *Advances in health sciences education*. 2009;14(4):595–621. doi:10.1007/s10459-007-9090-2
 10. Dewey J. *Experience and education*. Taylor & Francis; 1986:241–252.
 11. Lewin D. Toward a theory of pedagogical reduction: Selection, simplification, and generalization in an age of critical education. *Educational Theory*. 2018;68(4-5):495–512. doi:10.1111/edth.12326
 12. Piaget J. *Piaget's theory*. Springer; 1976.
 13. Schon DA. Educating the reflective practitioner: Toward a new design for teaching and learning in the professions. *Australian Journal of Adult Learning*. 2010;50(2):448–451.
 14. Boud D, Cohen R, Sampson J. Peer learning and assessment. *Assessment & evaluation in higher education*. 1999;24(4):413–426.
 15. Lave J, Wenger E. *Situated learning: Legitimate peripheral participation*. Cambridge university press; 1991.
 16. Fierke KK, Lepp GA, Maxwell WD, Hager KD, Sucher BJ. Improving advanced pharmacy practice experiences with an intention/reflection practice. *Currents in Pharmacy Teaching and Learning*. 2019;11(4):394–401. doi:10.1016/j.cptl.2019.01.002
 17. Choi B. I'm Afraid of not succeeding in learning: Introducing an instrument to measure higher education students' fear of failure in learning. *Studies in Higher Education*. 2021;46(11):2107–2121. doi:10.1080/03075079.2020.1712691
 18. Raddum A, Le QBT, Herfindal L, et al. Fostering student agency and confidence through problem-based learning and cognitive reflection in the pharmaceuticals laboratory. *Pharmacy Education*. 2025;25(1):42–52. doi:10.46542/pe.2025.251.4252
 19. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative research in psychology*. 2006;3(2):77–101. doi:10.1191/1478088706qp063oa
 20. Temple B, Young A. Qualitative research and translation dilemmas. *Qualitative research*. 2004;4(2):161–178. doi:10.1177/1468794104044430
 21. Priddis L, Rogers SL. Development of the reflective practice questionnaire: preliminary findings. *Reflective Practice*. 2018;19(1):89–104. doi:10.1080/14623943.2017.1379384
 22. Rogers SL, Priddis LE, Michels N, Tieman M, Van Winkle LJ. Applications of the reflective practice questionnaire in medical education. *BMC medical education*. 2019;19(1):47. doi:10.1186/s12909-019-1481-6
 23. Felten P. Principles of good practice in SoTL. *Teaching and Learning Inquiry: The ISSOTL Journal*. 2013;1(1):121–125. doi:10.2979/teachlearninqu.1.1.121
 24. Zeichner KM, Liston DP. *Reflective teaching: An introduction*. Routledge; 2013.
 25. Dulloo P, Vedi N, Patel M, Singh S. Empowering medical education: unveiling the impact of reflective writing and tailored assessment on deep learning. *Journal of Advances in Medical Education & Professionalism*. 2024;12(3):163. doi:10.30476/JAMP.2024.101594.1938
 26. Boud D. Avoiding the traps: Seeking good practice in the use of self assessment and reflection in professional courses. *Social work education*. 1999;18(2):121–132. doi:10.1080/02615479911220131.

Figure 1. Organization and overview of the Reflective Audio Note (RAN) Introductory Session

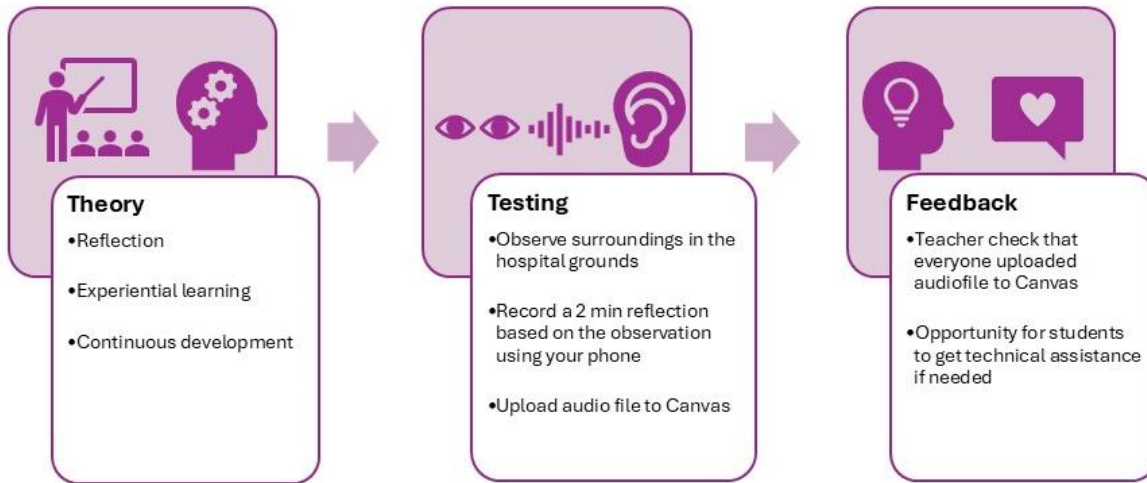


Figure 2. Overview of the use of RAN in different settings

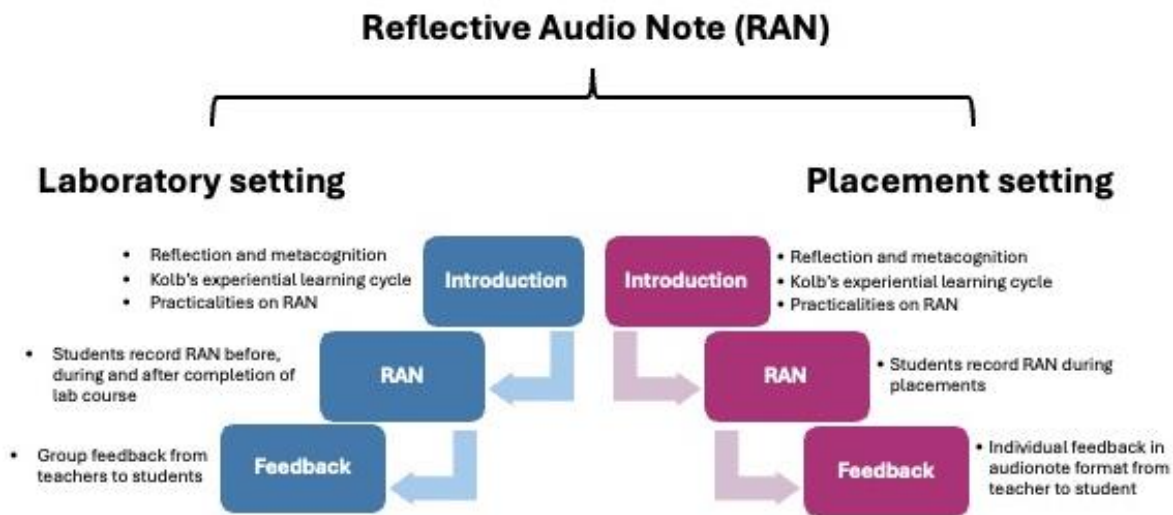


Figure 3. Fourth-year Clinical Pharmacy students' preferences for using audio or written reflections during placement (Fall 2021)

